AD-A069 102 KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA F/G 13/2
NATIONAL DAM SAFETY PROGRAM. BRADFORD DAM (INVENTORY NUMBER NY---ETC(U)
SEP 78 R J KIMBALL DACW51-78-C-0025
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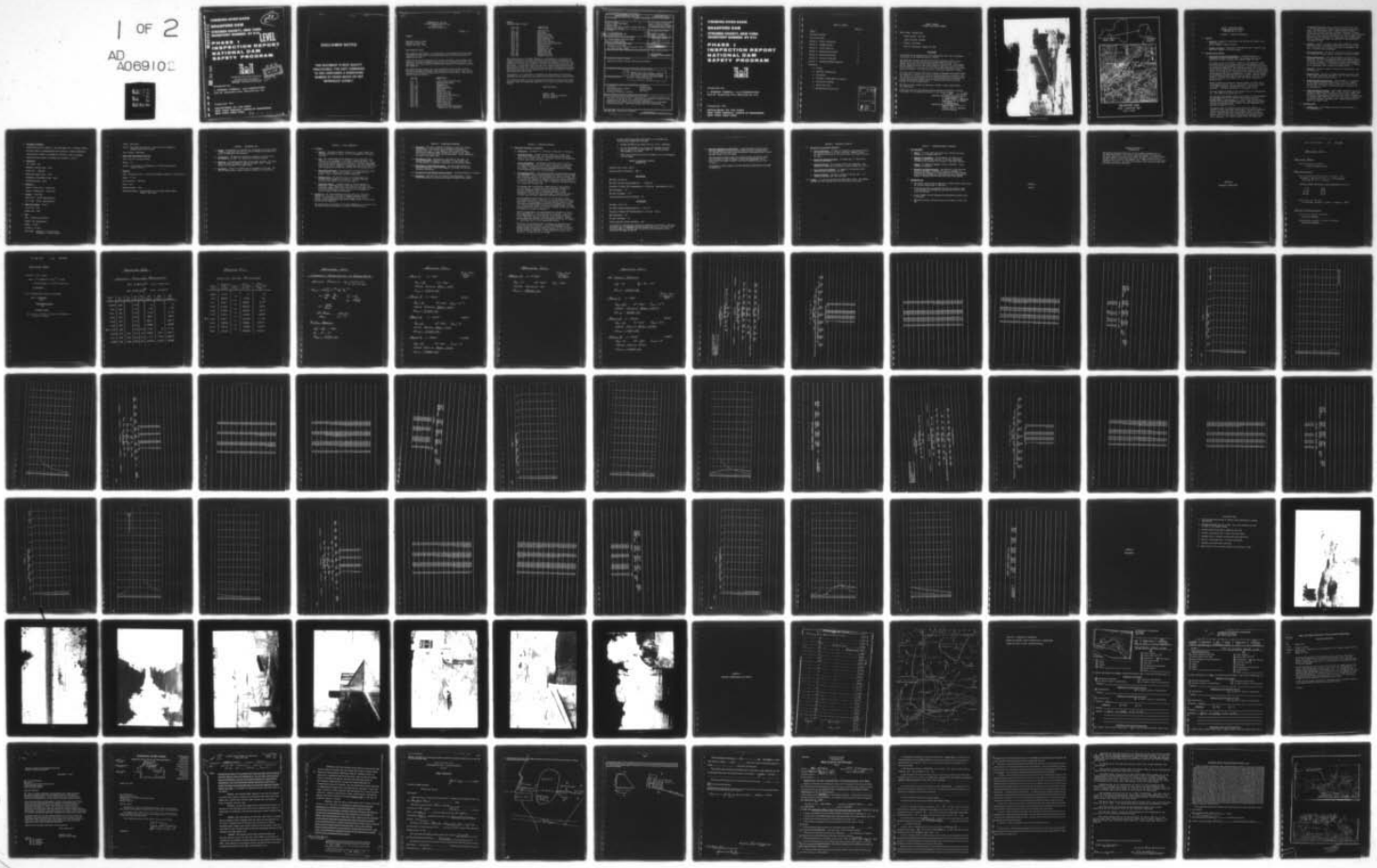

CHEMUNG RIVER BASIN

BRADFORD DAM

STEUBEN COUNTY, NEW YORK
INVENTORY NUMBER NY 670

LEVEL II

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

CONTRACT NO. DACW-51-78-C-0025

Prepared by

L. ROBERT KIMBALL and ASSOCIATES
615 W. Highland Ave. Ebensburg, Pa.

Prepared For

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
NEW YORK, NEW YORK

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DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, NEW YORK
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

2 OCT 1.3

NANEN-F

Honorable Hugh L. Carey
Governor of New York
Albany, New York 12224

Dear Governor Carey:

The purpose of this letter is to inform you of a clarification of the guidelines used by this office in assessing dams under the National Program of Inspection of Dams.

Office of the Chief of Engineers has recently provided a clarification that dams with seriously inadequate spillways are to be assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The following dams in your state have previously been assessed as having seriously inadequate spillways, with capability to pass safely only the percentage of the probable maximum flood as noted in each report. They are now to be assessed as unsafe:

I.D. NO.	NAME OF DAM
N.Y. 59	Lower Warwick Reservoir Dam
N.Y. 4	Salisbury Mills Dam
N.Y. 45	Amawalk Dam
N.Y. 418	Jamesville Dam
N.Y. 685	Colliersville Dam
N.Y. 6	Delta Dam
N.Y. 421	Oneida City Dam
N.Y. 39	Croton Falls Dam
N.Y. 509	Chadwick Dam (Plattenkill)
N.Y. 66	Boyds Corner Dam
N.Y. 397	Cranberry Lake Dam
N.Y. 708	Seneca Falls Dam
N.Y. 332	Lake Sebago Dam
N.Y. 338	Indian Brook Dam
N.Y. 33	Lower(S) Wiccopee Dam (Lower Hudson W.S. for Peekskill)

NANEN-F
Honorable Hugh L. Carey

I.D. NO.	NAME OF DAM
N.Y. 49	Pocantico Dam
N.Y. 445	Attica Dam
N.Y. 658	Cork Center Dam
N.Y. 153	Jackson Creek Dam
N.Y. 172	Lake Algonquin Dam
N.Y. 318	Sixth Lake Dam
N.Y. 13	Butlet Storage Dam
N.Y. 90	Putnam Lake (Bog Brook Dam)
N.Y. 166	Pecks Lake Dam
N.Y. 674	Bradford Dam
N.Y. 75	Sturgeon Pool Dam
N.Y. 414	Skaneateles Dam
N.Y. 155	Indian Lake Dam
N.Y. 472	Newton Falls Dam
N.Y. 362	Buckhorn Lake Dam

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

Consequently, it is advisable to implement the recommendations previously furnished in the reports for the above-mentioned dams as soon as practicable.

It is requested that owners of these dams be furnished a copy of this letter and that copies be permanently appended to all reports previously furnished to you.

Sincerely yours,

CLARK H. BENN
Colonel, Corps of Engineers
District Engineer

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

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3. RECIPIENT'S CATALOG NUMBER

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Phase I Inspection Report
Bradford Dam
Chemung River Basin, Steuben County, New York
Inventory No. NY 670

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National Dam Safety Program

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Ebensburg, Pennsylvania

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Dam Safety
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Visual Inspection
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Bradford Dam
Steuben County
Mud Creek

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.
Bradford Dam was judged to be unsafe-non emergency due to a seriously inadequate spillway. Additional studies were also recommended.

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CHEMUNG RIVER BASIN

BRADFORD DAM

STEUBEN COUNTY, NEW YORK
INVENTORY NUMBER NY 670

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

Prepared by

L. ROBERT KIMBALL and ASSOCIATES
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Prepared For

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
NEW YORK, NEW YORK

TABLE OF CONTENTS

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Bradford Dam

State Located: New York

County Located: Steuben

Stream: Mud Creek

Date of Inspection: August 30, 1978

ASSESSMENT

At the time of the inspection of the Bradford Dam, there were no apparent indications of an immediate hazard to safety.

The hydrologic analysis indicates the present spillway facility is not sufficient to pass the Spillway Design Flood (SDF) which for a low hazard, large size dam is the range between 1/2 PMF and PMF. The spillway has the capacity for only 46% of the required outflow to control the SPF. As the spillway can pass less than half of the SPF (approximately the lower limit of the SDF). It should be given a "seriously inadequate" rating.

The owner should complete additional studies to determine what modifications are necessary to provide the necessary spillway capacity at the site. In the interim the sluice gates should be opened during heavy rainfall periods and the lake level maintained at as low an operating level as possible. A routine surveillence program should be developed, particularly during periods of notable precipitation.

The concrete apron should be repaired to prevent further deterioration and undermining.

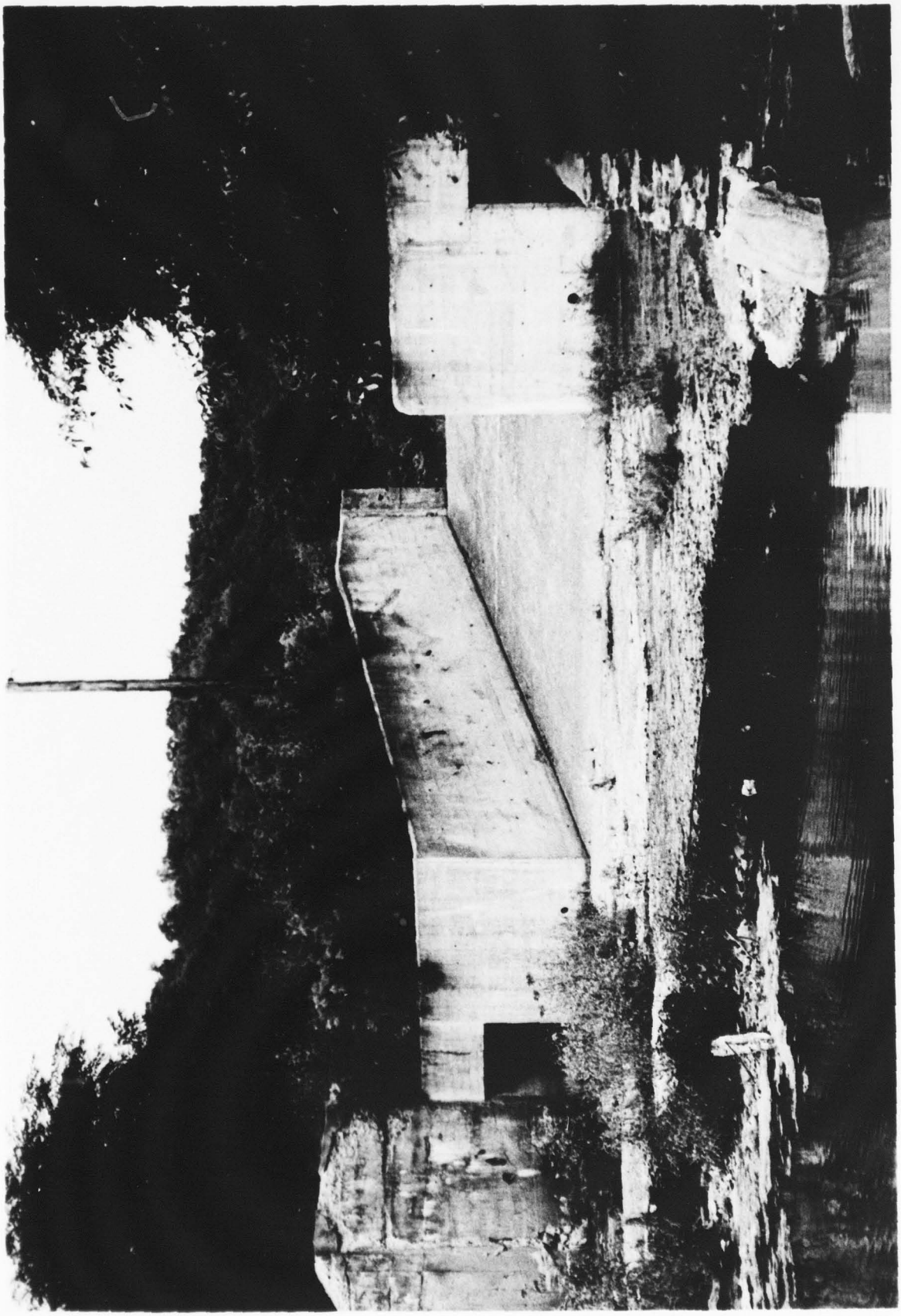
A detailed stability and seepage analysis should be performed to evaluate the seepage in the embankment adjacent to the concrete section.

Approved by: R. Jeffrey Kimball

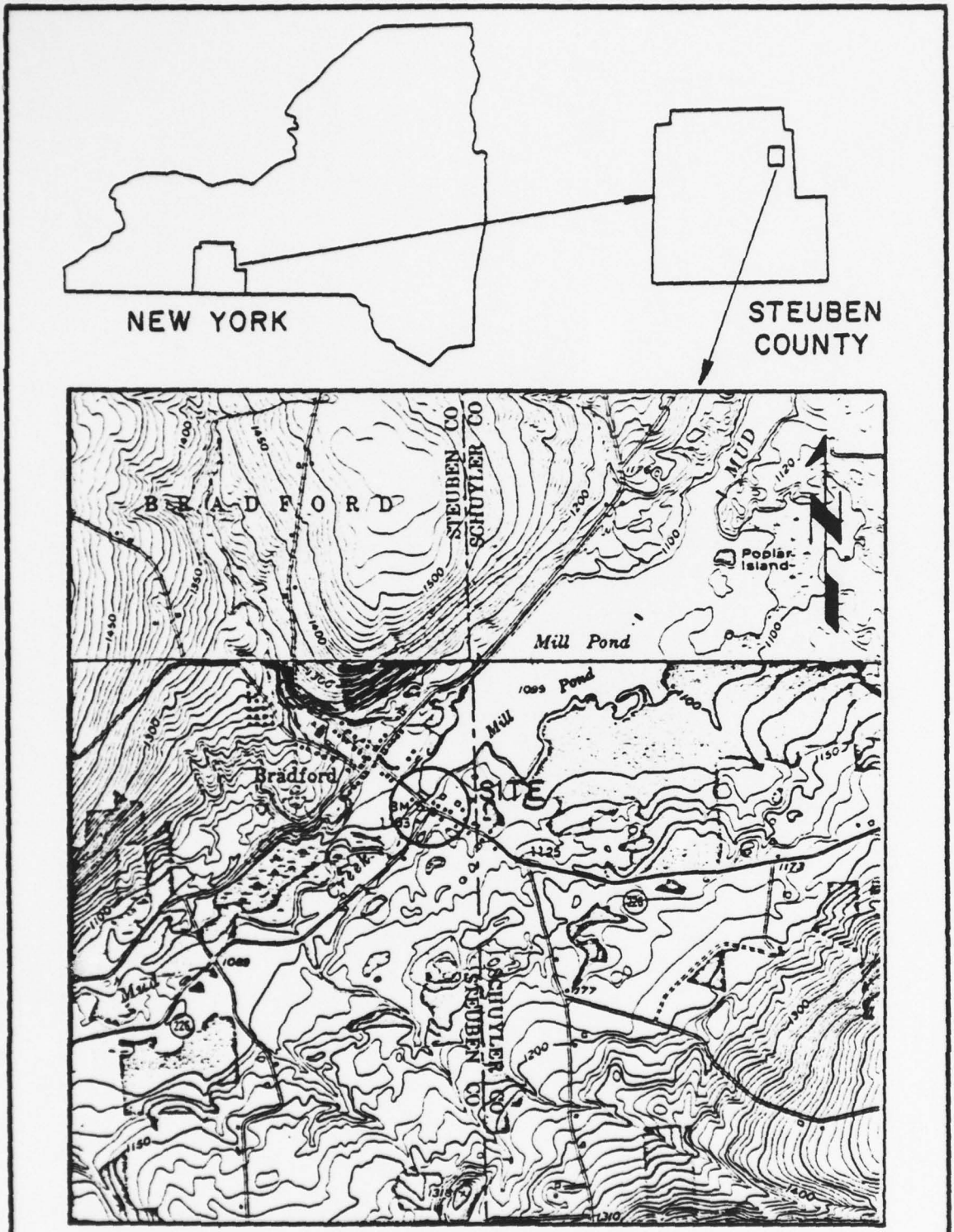
R. Jeffrey Kimball, P.E.
L. ROBERT KIMBALL & ASSOCIATES
Registration No. PA 26275E

Approved by: Clark H. Benn

CLARK H. BENN
Colonel, Corps of Engineers
District Engineer



OVERVIEW FROM DOWNSTREAM



BRADFORD DAM

SITE LOCATION MAP

SCALE: 1" = 2000'

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BRADFORD DAM ID # 674

SECTION 1: PROJECT INFORMATION

1.1 General:

a. Authority: Authority is provided by the National Dam Inspection Act Public Law 92-367.
Contract Number: DACW51-78-C-0025

b. Purpose of Project: Evaluation of non-Federal dams to identify dams which are a threat to life and property.

1.2 Description of Project:

a. Description of Dam and Appurtenances: The Bradford Dam is a combination concrete and earth dam. The existing structure was constructed in 1950 to replace the original timber crib dam.

The center portion of the dam is formed by a concrete gravity dam and retaining wall type structure which forms the emergency overflow and houses the normal discharge facilities. A plan and cross-sections are included in Appendix E. The concrete section is 104' long at the longest section and 66' wide from the spillway crest to the downstream toe of the concrete apron. The center of the concrete structure has an opening which forms a broad crested weir 23' wide. This weir serves as the emergency spillway discharging to a concrete spillway channel formed by retaining walls and to a concrete apron. The crest of the spillway section is at elevation 1099. The top of the dam is at elevation 1105.

Normal discharge is through two concrete tunnels on either side of the emergency overflow. Flow is controlled by electrically opened sluice gates located on the upstream face of the concrete structure. The invert elevations of the tunnels is 1093.

The total structural height of the concrete section is approximately 19'. The height above stream bed is 13'.

The left and right abutment sections are formed by earth embankments. The embankments are short, heavily vegetated sections with a maximum height of approximately 13'. No reliable information is available on the earth embankment sections. Some data is available from the 1936 reconstruction. However, the earth embankment was apparently washed out in 1950.

The Bradford Dam is a relatively small structure, however, it controls a fairly large water surface area. The dam was apparently constructed across the outlet of two natural lakes of glacial origin. Bradford Dam is the southern most point of the complex. The dam forms Mill Pond which is connected to Lamoka Lake by Mud Creek, apparently the original natural outlet for Lamoka Lake.

Correspondence indicates that a canal was constructed in 1936 to connect Lamoka Lake to Wanetta Lake (previously called Little Lake). From the northern point of Wanetta Lake near Wayne, a channel was constructed through a natural topographic low point to carry water to the power penstack inlet. The canal is approximately 8500' long. Sluice gates are located in the canal at Wayne. The penstack inlet is controlled by a single gate with a trash screen. Power is produced near Keuka Lake some 360' in elevation below the penstack intake.

b. Location: The dam is located on Mud Creek at Bradford, Steuben County, New York. The Schayler County line is just east of the dam. The location of the dam can be found on the Bradford, New York, 7.5 minute series quadrangle.

c. Size Classification: The dam is a large structure with a height of 13 feet and a storage capacity in excess of 60,000 acre-feet.

d. Hazard Classification: Only one structure is located in the relatively wide flood plain between Bradford and Savona, 9 miles downstream. Little or no damage due to failure is anticipated as the structural height is low and the flood wave would dissipate in the wide flood plain. A low hazard classification is assigned. Future development could increase the hazard rating.

e. Ownership: The dam is owned by the New York State Electric and Gas Corporation.

f. Purpose of Dam: The dam is utilized to maintain the water level in Mill Pond, Lamoka Lake and Wanetta Lake for power production at the Keuka Lake hydropower station.

g. Design and Construction History: Some information is available on the original structure constructed at this site. However, the existing structure was built in 1950 after failure of the previous dam. No design or construction data is available for the existing dam.

h. Normal Operating Procedures: Under normal conditions, the dam is operated to maintain a water level of 1098 to 1099 in Lamoka Lake and Wanetta Lake. Water is extracted from the lakes, with the exception of summer months, through the canal north of Wanetta Lake to the Keuka Lake power penstock. The sluice gates are operated as needed to maintain the water level. Annual inspections are made by the owner's staff.

1.3 Pertinent Data:

a. Drainage Area: The drainage area above the dam and lakes is 44.8 square miles.

b. Discharge at Damsite:

Maximum known flood at damsite: Hurricane Agnes 1972 - discharge unknown

Spillway Capacity at maximum design pool elevation: Unknown design pool

Gated Spillway capacity at maximum pool elevation: 800 cfs estimated

Ungated Spillway capacity at maximum pool elevation: 1116 cfs

c. Elevations:

Top of dam: 1105

Emergency Spillway Crest: 1099

Normal Pool: 1098-1099

Regulating Tunnel Invert: 1093

Streambed at Centerline of Dam: 1091.7

Maximum Tailwater: 1091.7

d. Reservoir:

Length of normal pool: 38,000 feet

Length of Maximum Pool: 38,000 feet

e. Storage: (acre-feet)

Normal Pool: 60,000 (approximately)

Top of Dam: 74,000 (approximately)

f. Reservoir Surface: (acres)

Top of dam: 2380

Normal Pool: 2200

g. Dam:

Type: Concrete and Earthfill

Length: 183' approximately

Height: 13 feet

Top Width: 28 feet

Side Slopes: Upstream 2:1 earth section
Downstream 2:1 earth section

Zoning: None known

Cutoff: None known earth section - concrete section apparently extended below natural ground

Grout Curtain: None Known

h. Water Level Regulating Facilities:

Type: Two 5'x5' concrete tunnels

Length: 29'

Closure: Sluice gates on upstream face of concrete section with electric motors.

i. Spillway:

Type: Broadcrested weir to concrete rectangular channel to concrete apron

Length: 29 feet

Crest Elevation: 1099 feet

Gates: None

Upstream Channel: None

Downstream Channel: Concrete apron to rock channel under highway bridge to Mud Creek.

SECTION 2: ENGINEERING DATA

2.1 Design: No information is available on the design of the existing dam. A drawing prepared by the owner in 1978 is available which shows what detail is known about the structure.

2.2 Construction: The dam was constructed to replace a structure which was washed out in 1950. No construction data was available.

2.3 Operation: No detailed operational records were reviewed. The sluice gates are opened as needed to regulate the water level. Annual inspections are made by the owners staff.

2.4 Evaluation: Little or no design data is available for the dam. The data is insufficient to make a complete analysis of the structure.

SECTION 3: VISUAL INSPECTION

3.1 Findings:

a. General: The Bradford Dam was inspected by L. Robert Kimball and Associates personnel on August 30, 1978 accompanied by the owners personnel.

b. Dam: The concrete dam section appeared to be in relatively good condition. No settlement or structural cracking was noted. The concrete apron downstream is in relatively poor conditon with large holes where water is flowing under the apron. The earth embankment sections are heavily vegetated. Seepage was noted at the base of the right abutment section near the junction with the concrete section.

c. Appurtenant Structures: One sluice hoist is direct drive the other is belt driven. The structures appear to be relatively old. However, they are reportedly exercised frequently.

d. Reservoir Area: The reservoir area is two large lakes with considerable development on the shores. The lake shore and adjacent slopes appear to be relatively stable.

e. Downstream Channel: A highway bridge is located immediately downstream. The bridge deck is above the top of the dam. The downstream channel is Mud Creek which drains to the Cohocton River, nine miles downstream in Savona. Little or no development is located along Mud Creek below Bradford.

3.2 Evaluation: The visual inspection did not reveal any signs which indicate the structure is in need of immediate emergency repair. However, the downstream apron should be repaired in the future to prevent further deterioration and possible undercutting of the concrete dam section and wingwalls.

The seepage noted at the base of the earth embankment at the contact with concrete section was sufficient to require further evaluation.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures: The dam is operated to maintain a lake level between 1098 and 1099. If necessary the sluice gates are opened to maintain this level. In the summer no water is used for power production as numerous summer cottages are located on the lakes and a normal pool water level must be maintained. Annual inspections are made by the owners staff.

4.2 Maintenance of Dam: Maintenance is performed by the owner. No routine maintenance schedule is followed. At the present time some maintenance is necessary, particularly to the concrete apron.

4.3 Maintenance of Operating Facilities: The sluice gate hoists are exercised regularly. While they appear to be rather old they are reportedly operational.

4.4 Description of Any Warning System in Effect: No warning system is in effect.

4.5 Evaluation: The structure is in need of some maintenance. A more routine maintenance and inspection program is needed in the future.

SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 Hydrologic Evaluation of Features:

a. Design Data: No hydraulic or hydrologic design data is available.

b. Experience Record: The dam has been washed out at least twice in the past, 1936 and 1950. The structure withstood Hurricane Agnes in 1972 without problems. No rainfall records are maintained. No daily water level records are kept.

c. Visual Observations: Considerable storm water can be stored in the large lake area. The outlet canal to the north is controlled in a manner that normal overflow would be through the Bradford Dam spillway. During peak spillway discharges additional damage to the downstream apron will be experienced.

d. Overtopping Analysis: Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and subsequent routing of the PMF through the reservoir system. The PMF is that hypothetical flow induced by the most critical combination of precipitation, minimum infiltration losses, and concentration of run-off at a specific location, that is considered reasonably possible for a particular drainage area.

The drainage area contributing to Bradford Dam is approximately 45 square miles. To develop the basic hydrologic working tool, the unit hydrograph, Snyder Coefficients were used. After discussions with the Corps of Engineers personnel, assumed parameters of Cp=0.60 and Ct=2.0 were used. A value of Tp equal to 5.9 hours was calculated considering watershed size and shape.

Using hydrometeorological Report No. 33, the PMP index rainfall was determined to be 22.2 inches for a 24 hour duration, 200 square mile basin. The percentages of the index rainfall applied to other durations were interpolated from the plot of drainage area versus cfs. After routing the PMF through the impounded storage, the peak flow was reduced to 12,826 cfs. A plot of the PMF inflow and outflow hydrographs is included in Appendix B.

The PMF is equivalent to an approximate water elevation of 1112.5 feet, approximately 7.5 feet over the top of the dam. Controls at the northern most part of the lake may be overtopped during this storm. Therefore, the water level may not be accurate. However, this analysis does indicate that the existing facilities are capable of controlling only 9% of the required PMF outflow.

The ability of the Bradford Dam to discharge the standard project flood (SPF) was also evaluated. The inflow hydrograph for the standard project flood with a peak flow 19,241 cfs was calculated. Routing through the impounded storage reduced the flow to 2,435 cfs. The SPF outflow is indicative of a pool elevation of 1106.6 feet above MSL, 1.6 above the top of the dam.

To allow inflow and outflow hydrographs to be developed and routed several assumptions were made:

1. Storage information was taken from the U.S.G.S. quadrangle.

2. All flow was assumed to be through the emergency spillway with no outflow to the power penstock. The sluice gates were assumed to be closed.

3. Water level before the storm was assumed to be at the emergency spillway level.

SUMMARY OF HYDROLOGIC ANALYSIS
BRADFORD DAM

Elevation Top of Dam = 1105.0

Elevation Crest of Spillway: 1099.0

PMF ROUTING

PMF Peak: 50,148 cfs

PMF After Routing through Reservoir: 12,826 cfs

Elevation of Routed PMF Corresponding to 12,826 cfs: Approximately 1112.5'

Dam Overtopped: 7.5'

Spillway Surcharge: 13.5'

Percent Required Outflow Available: 9%

SPF ROUTING

SPF Peak: 19,241 cfs

SPF After Routing Through Reservoir: 2,435 cfs

Elevation of Routed SPF Corresponding to 2,435 cfs: 1106.6

Dam Overtopped: 1.6'

Spillway Surcharge: 7.6'

Percent Required Outflow Available: 46%

As outlined by the Hydrologic Evaluation Guidelines a low hazard, large size structure, has a recommended Spillway Design Flood (SPF) of 1/2 PMF to PMF. The above analysis indicates that the spillway cannot adequately pass a storm with the range of the SDF.

5.2 Hydraulic Evaluation of Flood Wave: A dam break analysis of the flood wave was computed for both total and partial failures. Bradford Dam is a partial concrete gravity dam and earthfill dam making partial failure the most likely of the two cases.

The calculations indicate that for a partial breach the depth of water would be three (3) feet a distance of 4250 feet downstream. For a total failure the depth of water 14,700 feet downstream would be five (5) feet.

Calculations of water depths at various distances downstream are included in Appendix B.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability:

a. Visual Observation: No signs of instability were noted on either the concrete section or the earth sections. Seepage through the right earth section at the junction with the concrete section was noted.

b. Design and Construction Data: No design data or construction history is available.

c. Operating Records: No operating records were available. The reservoir is essentially operated at a near constant pool level.

d. Post Construction Changes: No changes to the structure were reported since construction in 1950.

e. Seismic Stability: The dam is located in seismic zone 1. No stability analysis have been performed.

6.2 Summary: No stability analyses have been done to date. The seepage through the right abutment earth section should be evaluated.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment:

a. Safety: No visual signs were noted which indicate the dam is presently in an unsafe condition.

b. Adequacy of Information: The information available was not adequate to analyze the stability of the dam. Sufficient information was available for the phase I hydrologic analysis.

c. Urgency: No immediate emergency action is required. Future studies are necessary.

d. Necessity for Additional Work: The stability of the structure should be evaluated. Additional studies are necessary to determine what measures if any are necessary to control seepage noted during the inspection. Additional hydrologic analyses are needed to determine what spillway modifications are needed.

7.2 Recommendations:

1. The concrete apron should be repaired to prevent further deterioration and possible undercutting of wing walls.

2. A detailed stability and seepage study should be made in light of the seepage noted through the structure and the lack of any stability analyses.

3. A more frequent routine inspection and maintenance program should be developed.

4. Additional spillway facilities should be provided to control the PMF.

APPENDIX A

GEOLOGY

GEOLOGICAL REVIEW OF
BRADFORD DAM

The Bradford Dam and reservoir lie in the Alleghany highlands part of the Applachian Uplands. The area was glaciated during the Pleistocene which left deposits of clays, silts, sands and gravels. The bedrock under the dam consists of shale and siltstone of the Upper Devonian Unadilla Formation which is part of the Genesee Group. There are no major structural features in the area. The strata are relatively flat lying, although they have been uplifted and dissected.

APPENDIX B

HYDROLOGIC COMPUTATIONS

NEW YORK DAM INSP DSG 8/29/78

BRADFORD DAM

DRAINAGE AREA:

FROM ENGINEER'S REPORT;
AREA = 99.8 SQ. MI.

PRECIPITATION:

FROM HYDROMETEOROLOGICAL REPORT 33,
PROBABLE MAXIMUM PRECIP. INDEX = 22.2"
(FOR 200 SQ. MI. - 24 HOUR)

DEPTH-AREA-DURATION RELATIONSHIPS (ZONE 2)

6 HR.	98%
12 HR.	108%
24 HR.	120%
48 HR.	131%

FROM EM 1110-2-1411,
STANDARD PROJECT PRECIP. INDEX = 9.8"

SNYDER COEFFICIENTS:

LENGTH OF MAIN CHANNEL:
L = 10.7 MILES

CENTROIDAL LENGTH OF MAIN CHANNEL:
LCA = 3.4 MILES

N.Y. DAM INSP. OSG 8/29/78

BRADFORD DAM

SNYDER'S LAG TIME:

$$t_{pR} = C_t (.955)(L \times L_{ca})^{.3} + .25\, t_R$$

$$= (2.0)(.955)(10.7 \times 3.4)^{.3} + .25(1.0)$$

$$= 5.9 \text{ HR.}$$

UNIT HYDROGRAPH PEAK DISCHARGE:

$$Q_{pR} = \frac{640\, C_p\, A}{t_{pR}}$$

$$= \frac{(640)(0.6)(44.8)}{5.9}$$

$$= 2916 \text{ CFS}$$

C_t AND C_p ASSUMED BASED ON MODELS OF SIMILAR AREAS

BRADFORD DAM

ELEVATION - DISCHARGE RELATIONSHIP

$Q_1 = 3.30 L_1 H_1^{3/2}$ FOR SPILLWAY

$Q_2 = 2.63 L_2 H_2^{3/2}$ FOR OVERTOP

ELEV. (FT)	L_1 (FT)	L_2 (FT)	H_1 (FT)	H_2 (FT)	Q_1 (CFS)	Q_2 (CFS)	Q_T (CFS)
1099	23		0.0		0		0
1100	23		1.0		76		76
1101	23		2.0		215		215
1102	23		3.0		394		394
1103	23		4.0		607		607
1104	23		5.0		849		849
T/DAM 1105	23		6.0	0.0	1116	0	1116
1106	23	160	7.0	1.0	1406	421	1827
1107	23	160	8.0	2.0	1717	1190	2907
1108	23	160	9.0	3.0	2049	2187	4236

BRADFORD DAM

ELEVATION - STORAGE RELATIONSHIP

	ELEV. (FT.)	SURFACE AREA (ACRES)	ΔELEV. (FT)	TOTAL STORAGE (AC-FT)	TOTAL DISCHARGE (CFS)
	1099	1573		0	0
			1.0		
	1100	2025		1799	76
			1.0		
	1101	2081		3852	215
			1.0		
	1102	2138		5962	394
			1.0		
	1103	2194		8128	607
			1.0		
	1104	2250		10,350	849
			1.0		
T/DAM	1105	2307		12,628	1116
			1.0		
	1106	2363		14,963	1827
			1.0		
	1107	2419		17,354	2907
			1.0		
	1108	2475		19,900	4236

BRADFORD DAM

HYDRAULIC EVALUATION OF FLOOD WAVE

STORAGE CAPACITY, V_b = 74,000 A.F. @ TOP OF DAM

$$Q_{MAX} = .29\sqrt{g}\, K^{.28} W_b D_b^{1.5}$$

$$K = \frac{W_d}{W_b} \cdot \frac{Y_o}{D_b} \qquad T_s = L\, t_s \qquad t_s = \Delta S / \Delta Q$$

$$S_i = \frac{12 V_b}{Q_{MAX}}$$

$$\frac{\text{ATT. } Q_{MAX}}{Q_{MAX}} = \frac{0.91\, S_i}{S_i + T_s}$$

A) FULL BREACH

$W_b = W_d = 183'$

$D_b = Y_o = 13'$

$Q_{MAX} = 14{,}420$ cfs

Bradford Dam

		Dist. from Dam
Reach 1	L = 950'	950'

D_{DS} = 8' W = 350'

Water Surface Elev. 1097'

Q_{MAX} = 13,310 cfs

Reach 2	L = 3300'	4250'

D_{DS} = 6' W = 500' D_{AVE} = 6.7'

Water Surface Elev. 1091'

Q_{MAX} = 12,350 cfs

Reach 3	L = 2600'	6850'

D_{DS} = 6' W = 425' D_{AVE} = 6'

Water Surface Elev. 1087'

Q_{MAX} = 10,500 cfs

Reach 4	L = 3150'	10,000'

D_{DS} = 6' W = 400' D_{AVE} = 6'

Water Surface Elev. 1085'

Q_{MAX} = 9880 cfs

BRADFORD DAM

		Dist. from Dam
REACH 5	L = 4700'	14,700'

$D_{MAX.}$ = 5' W = 450' $D_{AV.}$ = 5.3'

WATER SURFACE EL.

$Q_{MAX.}$ = 8460 cfs

Bradford Dam

B) Partial Breach

$W_b = 30'$ $D_b = Y_o = 13'$

$Q_{MAX} =$ 2365 cfs

		Dist. from Dam
Reach 1	$L = 950'$	950'

$D_{DS} = 3.5'$ $W = 200'$ $D_{AVE} = 6.7'$

Water Surface Elev. 1092.5'

$Q_{MAX} =$ 2200 cfs

Reach 2	$L = 3300'$	4250'

$D_{DS} =$ 3' $W = 220'$ $D_{AVE} = 3.2$

Water Surface Elev. 1088'

$Q_{MAX} =$ 1920 cfs

Reach 3	$L = 2600'$	6850'

$D_{DS} = 3'$ $W = 220'$ $D_{AVE} = 3'$

Water Surface Elev.

$Q_{MAX} =$ 1920 cfs

****
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
****

BRADFORD DAM
RESERVOIR AT SPILLWAY LEVEL
TEST SPF

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	1	0	0	0	0	0	2	0	0

JOPER	NWT
3	0

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SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	44.80	0.0	44.80	0.0	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
9.80	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.847

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	1.50	0.10	0.0	0.07

UNIT HYDROGRAPH DATA

TP 5.90 CP 0.60 NTA 0

RECESSION DATA

STRTQ 45.00 QRCSN -0.35 RTIOR 3.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC 6.69 AND R 5.78 INTERVALS

UNIT HYDROGRAPH 35 END-OF-PERIOD ORDINATES, LAG 5.92 HOURS, CP 0.61 VOL 1.00

188.	690.	1369.	2090.	2667.	2965.	2907.	2552.	2146.	1804.
1517.	1275.	1072.	901.	757.	637.	535.	450.	378.	318.
267.	225.	189.	159.	134.	112.	94.	79.	67.	56.
47.	40.	33.	28.	24.					

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.00	0.00	40.
2	0.00	0.00	36.
3	0.00	0.00	33.
4	0.00	0.00	29.
5	0.00	0.00	27.
6	0.00	0.00	24.
7	0.01	0.00	22.
8	0.01	0.00	20.
9	0.01	0.00	19.
10	0.01	0.00	18.
11	0.01	0.00	17.
12	0.01	0.00	17.
13	0.02	0.00	17.
14	0.03	0.00	17.
15	0.03	0.00	19.
16	0.09	0.01	23.
17	0.03	0.00	29.
18	0.03	0.00	37.
19	0.00	0.00	44.
20	0.00	0.00	49.
21	0.00	0.00	52.
22	0.00	0.00	50.

23	0.00	0.00	46.
24	0.00	0.00	41.
25	0.01	0.00	36.
26	0.01	0.00	31.
27	0.01	0.00	28.
28	0.01	0.00	25.
29	0.01	0.00	23.
30	0.01	0.00	21.
31	0.02	0.00	20.
32	0.02	0.00	20.
33	0.02	0.00	21.
34	0.02	0.00	23.
35	0.02	0.00	25.
36	0.02	0.00	28.
37	0.10	0.01	32.
38	0.12	0.01	39.
39	0.15	0.01	50.
40	0.39	0.03	70.
41	0.14	0.01	100.
42	0.11	0.01	137.
43	0.01	0.00	172.
44	0.01	0.00	198.
45	0.01	0.00	210.
46	0.01	0.00	206.
47	0.01	0.00	189.
48	0.01	0.00	167.
49	0.05	0.00	146.
50	0.05	0.00	129.
51	0.05	0.00	116.
52	0.05	0.00	108.
53	0.05	0.00	103.
54	0.05	0.00	100.
55	0.17	0.08	113.
56	0.17	0.08	163.
57	0.17	0.08	263.
58	0.17	0.08	415.

59	0.17	0.08	611.
60	0.17	0.08	828.
61	0.75	0.65	1149.
62	0.90	0.80	1762.
63	1.12	1.03	2855.
64	2.84	2.75	4876.
65	1.05	0.95	7995.
66	0.82	0.73	11742.
67	0.10	0.01	15387.
68	0.10	0.01	18058.
69	0.10	0.01	19241.
70	0.10	0.01	18795.
71	0.10	0.01	17044.
72	0.10	0.01	14762.
73	0.00	0.00	12519.
74	0.00	0.00	10551.
75	0.00	0.00	8891.
76	0.00	0.00	7490.
77	0.00	0.00	6481.
78	0.00	0.00	5807.
79	0.01	0.00	5202.
80	0.01	0.00	4661.
81	0.01	0.00	4176.
82	0.01	0.00	3742.
83	0.01	0.00	3352.
84	0.01	0.00	3004.
85	0.04	0.00	2691.
86	0.05	0.00	2411.
87	0.06	0.00	2160.
88	0.15	0.06	1936.
89	0.06	0.00	1734.
90	0.04	0.00	1554.
91	0.01	0.00	1392.
92	0.01	0.00	1247.
93	0.01	0.00	1117.
94	0.01	0.00	1001.

95	0.01	0.00	897.
96	0.01	0.00	804.
97	0.0	0.0	720.
98	0.0	0.0	645.
99	0.0	0.0	578.
100	0.0	0.0	518.
SUM	11.46	7.60	236638.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	19241.	17214.	8822.	3275.	236637.
INCHES		3.57	7.33	8.16	8.19
AC-FT		8540.	17508.	19497.	19567.

OVF

STATION 1

INFLOW I , OUTFLOW O AND OBSERVED FLOW *

0.	4000.	8000.	12000.	16000.	20000.	0.	0.	0.	0.	0.	0.
										PRECIP L	AND EXC
0.	0.	0.	0.	0.	0.	0.	0.	0.	3.	2.	1.
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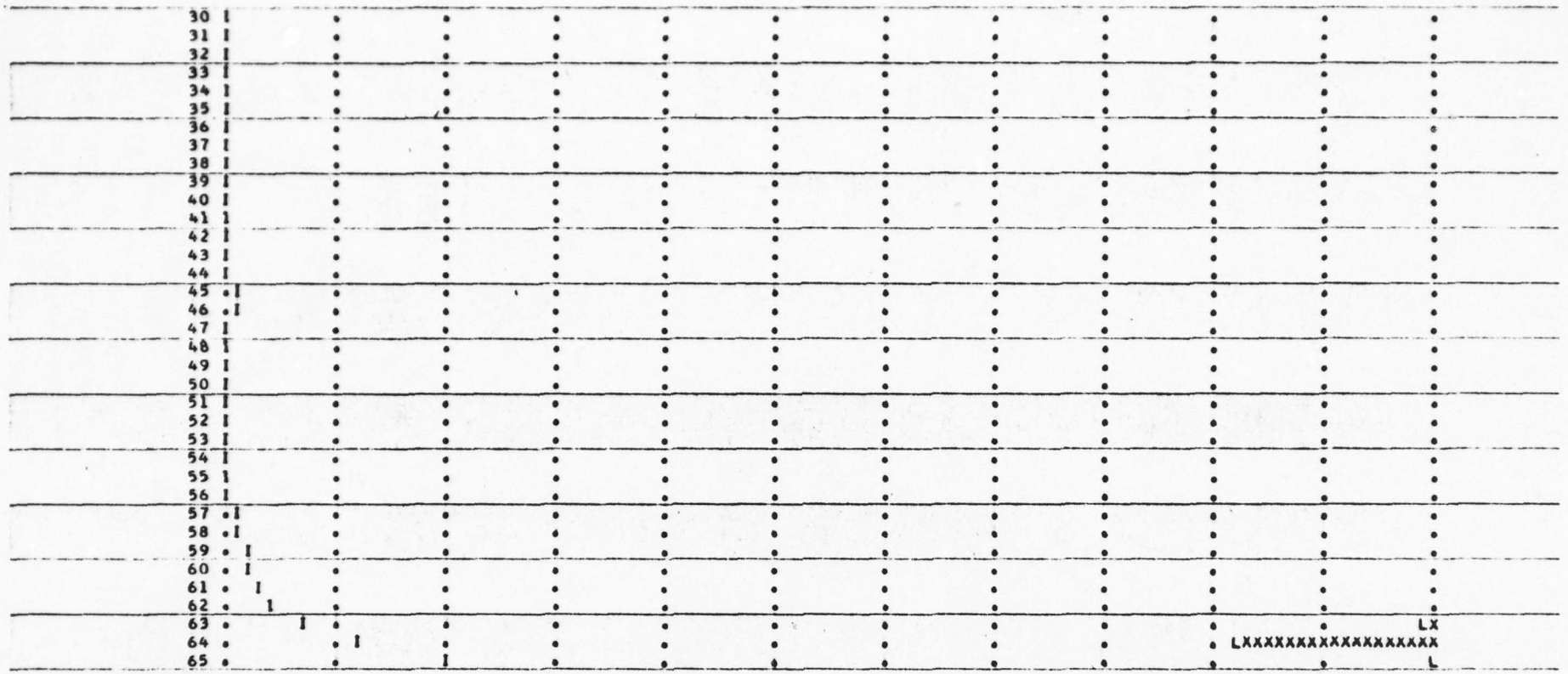
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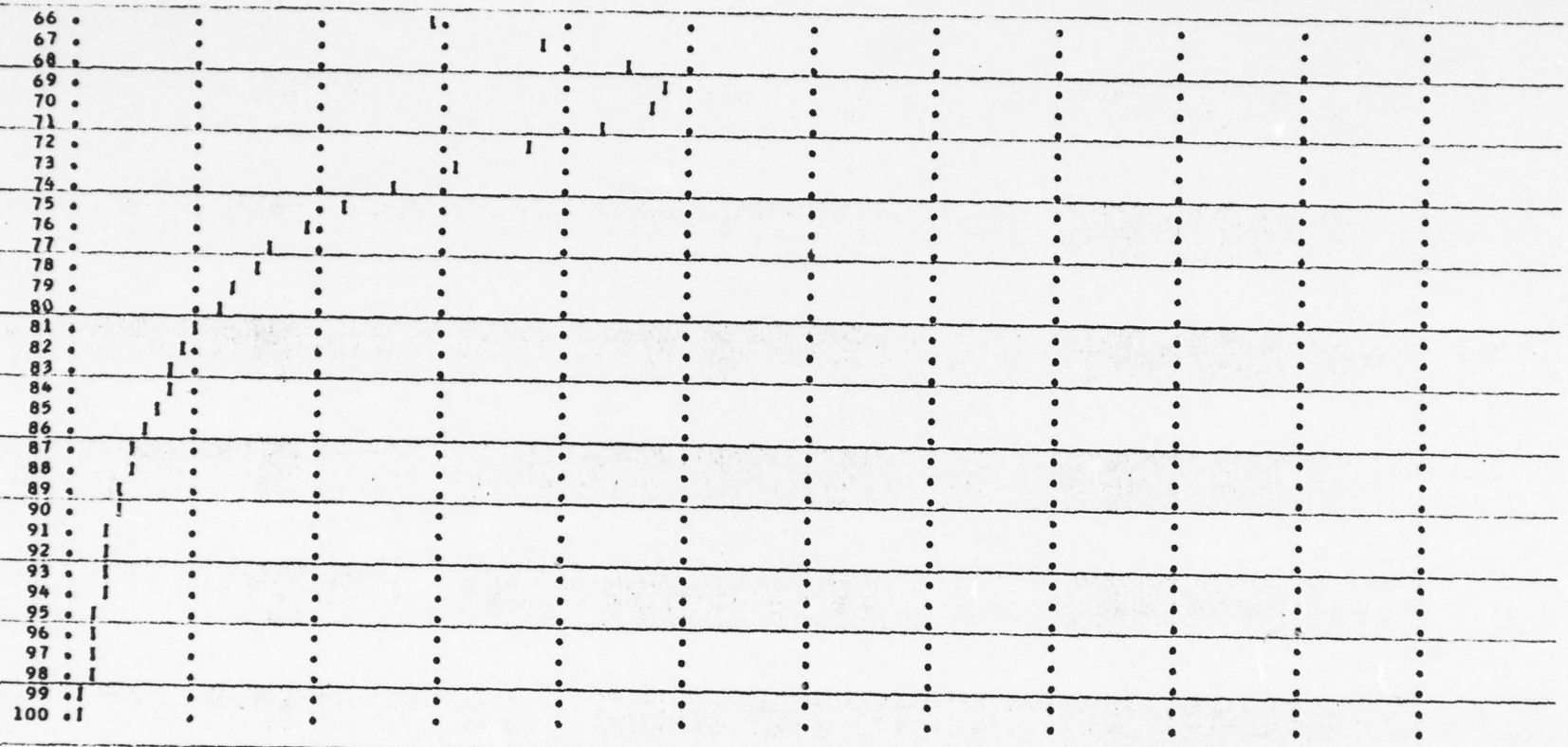
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HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE	0.	1799.	3852.	5962.	8128.	10350.	12628.	14963.	17354.	19800.
OUTFLOW	0.	76.	215.	394.	607.	849.	1116.	1827.	2907.	4236.

TIME	EOP STOR	AVG IN	EOP OUT
1	955.	40.	40.
2	955.	38.	40.
3	954.	34.	40.
4	953.	31.	40.
5	952.	28.	40.
6	951.	25.	40.
7	950.	23.	40.
8	948.	21.	40.
9	947.	20.	40.
10	945.	19.	40.
11	943.	18.	40.
12	941.	17.	40.
13	939.	17.	40.
14	937.	17.	40.
15	936.	18.	40.
16	934.	21.	39.
17	933.	26.	39.

18	932.	33.	39.
19	932.	40.	39.
20	933.	47.	39.
21	934.	50.	39.
22	935.	51.	39.
23	936.	48.	40.
24	936.	43.	40.
25	936.	38.	40.
26	935.	33.	40.
27	935.	30.	39.
28	933.	26.	39.
29	932.	24.	39.
30	931.	22.	39.
31	929.	21.	39.
32	928.	20.	39.
33	926.	20.	39.
34	925.	22.	39.
35	923.	24.	39.
36	922.	27.	39.
37	922.	30.	39.
38	921.	35.	39.
39	922.	44.	39.
40	924.	60.	39.
41	927.	85.	39.
42	934.	119.	39.
43	943.	154.	40.
44	955.	185.	40.
45	969.	204.	41.
46	983.	208.	42.
47	995.	197.	42.
48	1007.	178.	43.
49	1016.	156.	43.
50	1024.	137.	43.
51	1030.	122.	44.
52	1036.	112.	44.
53	1041.	105.	44.

54	1046.	101.	44.
55	1051.	107.	44.
56	1059.	138.	45.
57	1073.	213.	45.
58	1097.	339.	46.
59	1135.	513.	48.
60	1191.	719.	50.
61	1268.	988.	54.
62	1384.	1456.	58.
63	1569.	2309.	66.
64	1883.	3866.	82.
65	2406.	6436.	117.
66	3210.	9868.	172.
67	4313.	13564.	254.
68	5670.	16722.	369.
69	7174.	18650.	513.
70	8697.	19018.	669.
71	10117.	17919.	824.
72	11357.	15903.	967.
73	12399.	13640.	1089.
74	13254.	11535.	1306.
75	13940.	9721.	1516.
76	14485.	8191.	1681.
77	14918.	6985.	1813.
78	15270.	6144.	1965.
79	15557.	5504.	2095.
80	15787.	4932.	2199.
81	15967.	4419.	2280.
82	16103.	3959.	2342.
83	16201.	3547.	2386.
84	16265.	3178.	2415.
85	16300.	2847.	2431.
86	16310.	2551.	2435.
87	16298.	2286.	2430.
88	16267.	2048.	2416.
89	16220.	1835.	2395.

90	16159.	1644.	2367.
91	16086.	1473.	2334.
92	16004.	1320.	2297.
93	15913.	1182.	2256.
94	15816.	1059.	2212.
95	15714.	949.	2166.
96	15607.	850.	2118.
97	15497.	762.	2068.
98	15385.	683.	2017.
99	15270.	612.	1966.
100	15155.	548.	1914.
SUM			65506.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2435.	2420.	2222.	894.	65506.
INCHES		0.50	1.85	2.23	2.27
AC-FT		1201.	4409.	5324.	5417.

OVF

STATION 2

INFLOW I , OUTFLOW O AND OBSERVED FLOW *

	0.	4000.	8000.	12000.	16000.	20000.	0.	0.	0.	0.	0.	0.
1	I	.	.	.	.	.	.	.	.	.	.	.
2	I	.	.	.	.	.	.	.	.	.	.	.
3	I	.	.	.	.	.	.	.	.	.	.	.
4	I	.	.	.	.	.	.	.	.	.	.	.
5	I	.	.	.	.	.	.	.	.	.	.	.
6	I	.	.	.	.	.	.	.	.	.	.	.
7	I	.	.	.	.	.	.	.	.	.	.	.
8	I	.	.	.	.	.	.	.	.	.	.	.
9	I	.	.	.	.	.	.	.	.	.	.	.
10	I	.	.	.	.	.	.	.	.	.	.	.
11	I	.	.	.	.	.	.	.	.	.	.	.
12	I	.	.	.	.	.	.	.	.	.	.	.
13	I	.	.	.	.	.	.	.	.	.	.	.
14	I	.	.	.	.	.	.	.	.	.	.	.
15	I	.	.	.	.	.	.	.	.	.	.	.
16	I	.	.	.	.	.	.	.	.	.	.	.
17	I	.	.	.	.	.	.	.	.	.	.	.
18	I	.	.	.	.	.	.	.	.	.	.	.
19	I	.	.	.	.	.	.	.	.	.	.	.
20	I	.	.	.	.	.	.	.	.	.	.	.
21	I	.	.	.	.	.	.	.	.	.	.	.
22	I	.	.	.	.	.	.	.	.	.	.	.
23	I	.	.	.	.	.	.	.	.	.	.	.
24	I	.	.	.	.	.	.	.	.	.	.	.
25	I	.	.	.	.	.	.	.	.	.	.	.
26	I	.	.	.	.	.	.	.	.	.	.	.
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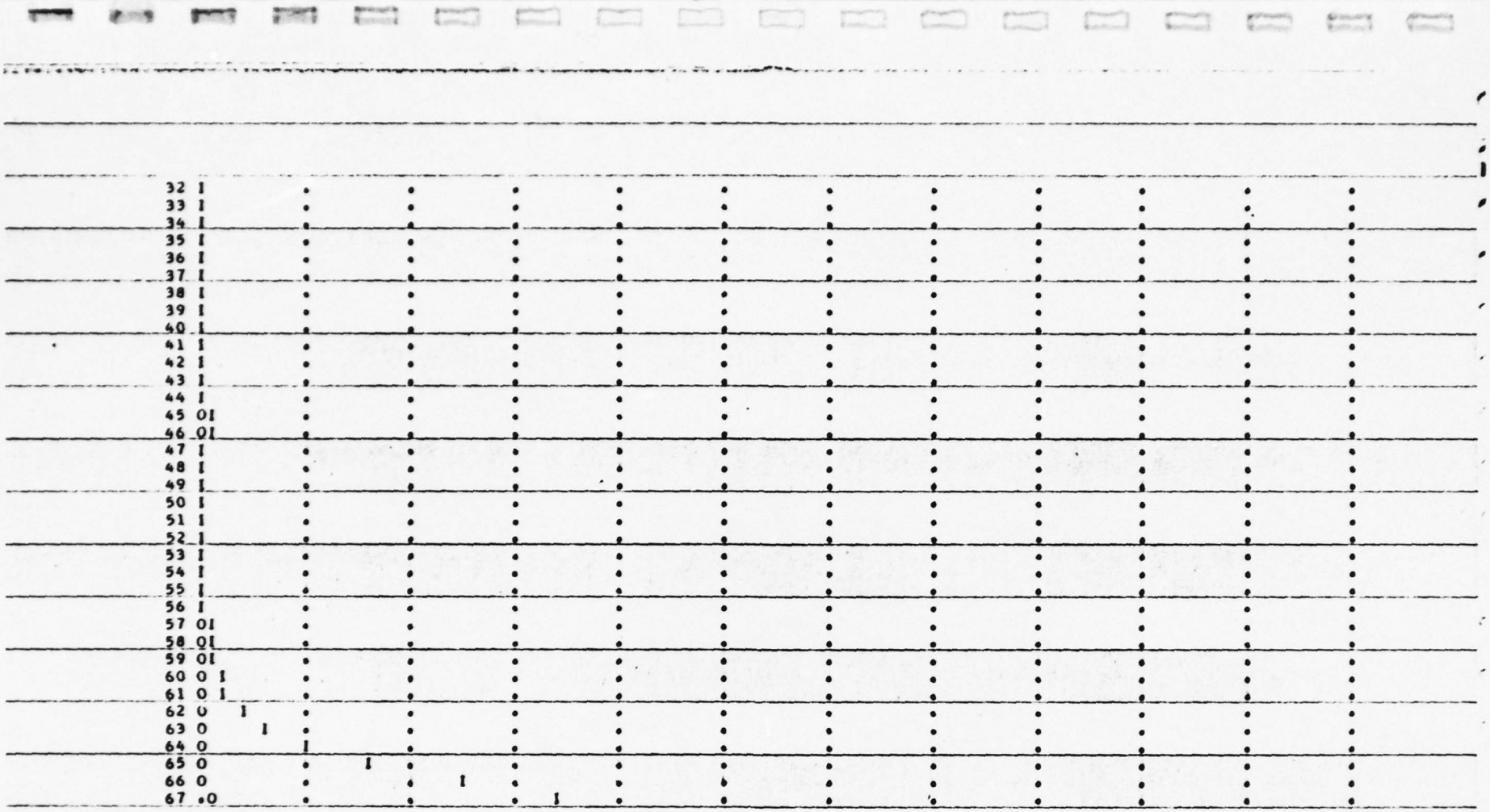
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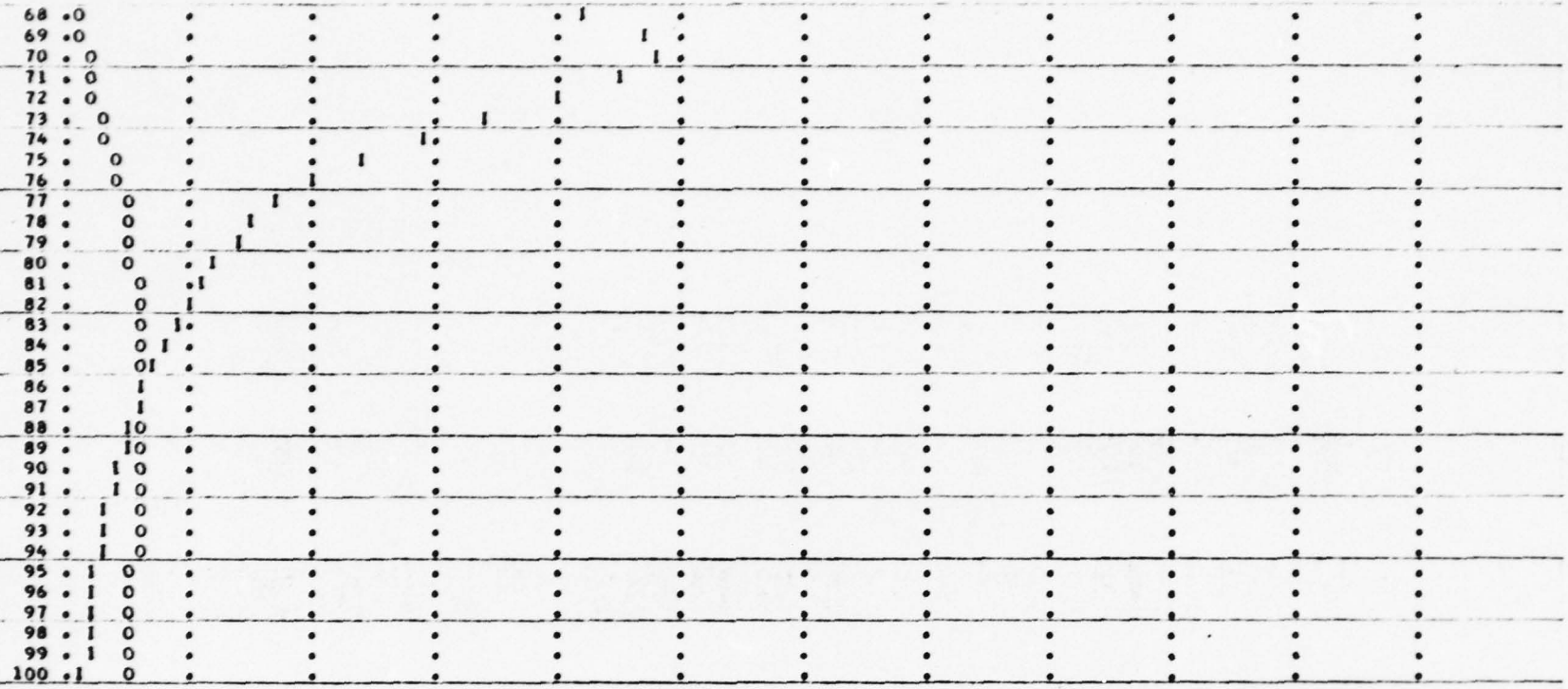
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RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	19241.	17214.	8822.	3275.	44.80
ROUTED TO	2	2435.	2420.	2222.	894.	44.80

****
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
****

BRADFORD DAM
RESERVOIR AT SPILLWAY LEVEL
TEST PMF

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	1	0	0	0	0	0	2	0	0

JOPER	NWT
3	0

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SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	44.80	0.0	44.80	0.0	0.0	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	22.20	98.00	108.00	120.00	131.00	0.0	0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.847

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	1.50	0.10	0.0	0.07

UNIT HYDROGRAPH DATA

TP 5.90 CP 0.60 NTA 0

RECESSION DATA

STRTQ 45.00 QRCSN -0.35 RTIOR 3.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC 6.69 AND R 5.78 INTERVALS

UNIT HYDROGRAPH 35 END-OF-PERIOD ORDINATES, LAG 5.92 HOURS, CP 0.61 VOL 1.00

188.	690.	1369.	2090.	2667.	2965.	2907.	2552.	2146.	1804.
1517.	1275.	1072.	901.	757.	637.	535.	450.	378.	318.
267.	225.	189.	159.	134.	112.	94.	79.	67.	56.
47.	40.	33.	28.	24.					

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.01	0.00	40.
2	0.01	0.00	37.
3	0.01	0.00	35.
4	0.01	0.00	33.
5	0.01	0.00	33.
6	0.01	0.00	33.
7	0.03	0.00	33.
8	0.03	0.00	34.
9	0.03	0.00	36.
10	0.03	0.00	38.
11	0.03	0.00	41.
12	0.03	0.00	44.
13	0.17	0.01	49.
14	0.20	0.01	58.
15	0.25	0.02	76.
16	0.64	0.06	112.
17	0.24	0.14	195.
18	0.19	0.09	346.
19	0.02	0.00	543.
20	0.02	0.00	742.
21	0.02	0.00	897.
22	0.02	0.00	973.

23	0.02	0.00	957.
24	0.02	0.00	864.
25	0.15	0.06	754.
26	0.15	0.06	681.
27	0.15	0.06	663.
28	0.15	0.06	701.
29	0.15	0.06	784.
30	0.15	0.06	894.
31	0.31	0.22	1040.
32	0.31	0.22	1256.
33	0.31	0.22	1566.
34	0.31	0.22	1979.
35	0.31	0.22	2475.
36	0.31	0.22	3010.
37	1.84	1.75	3814.
38	2.21	2.12	5389.
39	2.76	2.67	8220.
40	7.00	6.91	13415.
41	2.58	2.49	21378.
42	2.03	1.93	30919.
43	0.23	0.13	40202.
44	0.23	0.13	47038.
45	0.23	0.13	50148.
46	0.23	0.13	49191.
47	0.23	0.13	44976.
48	0.23	0.13	39422.
49	0.0	0.0	33922.
50	0.0	0.0	29032.
51	0.0	0.0	24816.
52	0.0	0.0	21146.
53	0.0	0.0	17940.
54	0.0	0.0	15980.
55	0.0	0.0	14317.
56	0.0	0.0	12828.
57	0.0	0.0	11493.
58	0.0	0.0	10297.

59	0.0	0.0	9226.
60	0.0	0.0	8266.
61	0.0	0.0	7406.
62	0.0	0.0	6636.
63	0.0	0.0	5945.
64	0.0	0.0	5327.
65	0.0	0.0	4772.
66	0.0	0.0	4276.
67	0.0	0.0	3831.
68	0.0	0.0	3432.
69	0.0	0.0	3075.
70	0.0	0.0	2755.
71	0.0	0.0	2469.
72	0.0	0.0	2212.
73	0.0	0.0	1982.
74	0.0	0.0	1776.
75	0.0	0.0	1591.
76	0.0	0.0	1425.
77	0.0	0.0	1277.
78	0.0	0.0	1144.
79	0.0	0.0	1025.
80	0.0	0.0	918.
81	0.0	0.0	823.
82	0.0	0.0	737.
83	0.0	0.0	661.
84	0.0	0.0	592.
85	0.0	0.0	530.
86	0.0	0.0	475.
87	0.0	0.0	426.
88	0.0	0.0	381.
89	0.0	0.0	342.
90	0.0	0.0	306.
91	0.0	0.0	274.
92	0.0	0.0	246.
93	0.0	0.0	220.
94	0.0	0.0	197.

95	0.0	0.0	177.
96	0.0	0.0	158.
97	0.0	0.0	142.
98	0.0	0.0	127.
99	0.0	0.0	114.
100	0.0	0.0	102.
SUM	24.61	20.66	655731.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	50148.	45163.	23676.	9066.	655733.
INCHES		9.38	19.66	22.59	22.69
AC-FT		22406.	46984.	53973.	54221.

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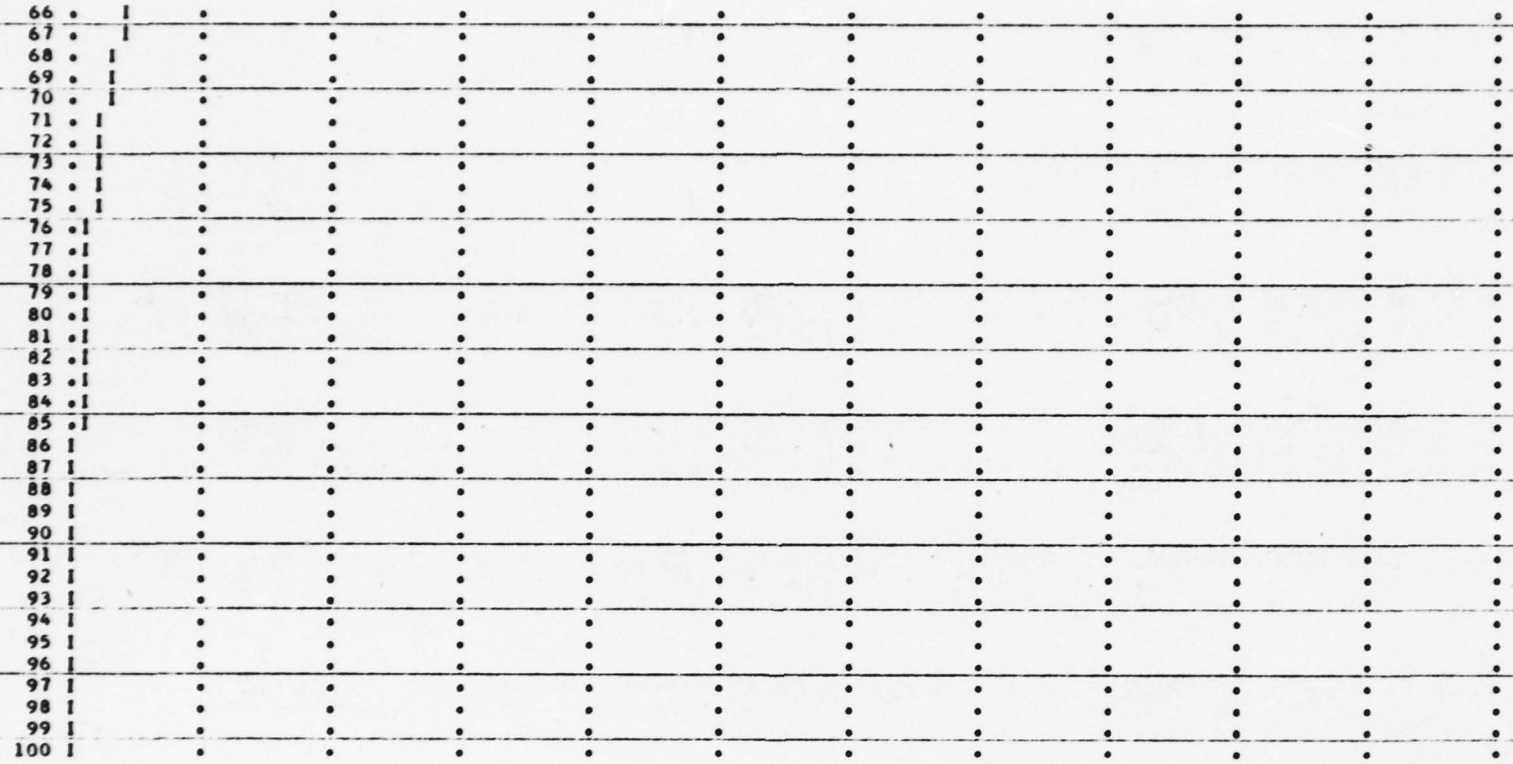
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HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE	0.	1799.	3852.	5962.	8128.	10350.	12628.	14963.	17354.	19800.
OUTFLOW	0.	76.	215.	394.	607.	849.	1116.	1827.	2907.	4236.

TIME	EOP STOR	AVG IN	EOP OUT
1	959.	40.	40.
2	959.	39.	40.
3	958.	36.	40.
4	958.	34.	40.
5	957.	33.	40.
6	956.	33.	40.
7	956.	33.	40.
8	955.	34.	40.
9	955.	35.	40.
10	955.	37.	40.
11	954.	40.	40.
12	955.	42.	40.
13	955.	46.	40.
14	956.	53.	40.
15	958.	67.	40.
16	963.	94.	41.
17	972.	153.	41.

18	991.	270.	42.
19	1024.	444.	43.
20	1074.	642.	45.
21	1137.	819.	48.
22	1211.	935.	51.
23	1286.	965.	54.
24	1357.	910.	57.
25	1419.	809.	60.
26	1473.	717.	62.
27	1523.	672.	64.
28	1574.	682.	67.
29	1630.	743.	69.
30	1694.	839.	72.
31	1767.	967.	75.
32	1856.	1148.	80.
33	1966.	1411.	87.
34	2105.	1773.	97.
35	2280.	2227.	109.
36	2497.	2742.	123.
37	2768.	3412.	142.
38	3136.	4602.	167.
39	3683.	6804.	204.
40	4557.	10817.	275.
41	5967.	17397.	395.
42	8087.	26149.	603.
43	10963.	35560.	921.
44	14461.	43620.	1674.
45	18267.	48593.	3403.
46	22006.	49670.	5435.
47	25373.	47084.	7264.
48	28197.	42199.	8798.
49	30450.	36672.	10022.
50	32184.	31477.	10965.
51	33474.	26924.	11666.
52	34389.	22981.	12163.
53	34985.	19543.	12487.

54	35347.	16960.	12683.
55	35546.	15149.	12791.
56	35609.	13573.	12826.
57	35555.	12160.	12796.
58	35402.	10895.	12713.
59	35163.	9762.	12583.
60	34853.	8746.	12415.
61	34483.	7836.	12214.
62	34063.	7021.	11986.
63	33603.	6290.	11736.
64	33110.	5636.	11468.
65	32591.	5050.	11186.
66	32052.	4524.	10893.
67	31500.	4053.	10593.
68	30937.	3632.	10287.
69	30368.	3254.	9978.
70	29798.	2915.	9668.
71	29227.	2612.	9358.
72	28660.	2340.	9050.
73	28098.	2097.	8745.
74	27543.	1879.	8443.
75	26997.	1683.	8146.
76	26460.	1508.	7855.
77	25934.	1351.	7569.
78	25420.	1211.	7290.
79	24919.	1085.	7017.
80	24430.	972.	6752.
81	23955.	871.	6493.
82	23493.	780.	6243.
83	23045.	699.	5999.
84	22611.	626.	5763.
85	22190.	561.	5535.
86	21783.	503.	5314.
87	21390.	450.	5100.
88	21011.	404.	4894.
89	20644.	362.	4695.

90	20291.	324.	4503.
91	19950.	290.	4318.
92	19622.	260.	4140.
93	19307.	233.	3968.
94	19003.	209.	3803.
95	18711.	187.	3644.
96	18430.	168.	3491.
97	18159.	150.	3345.
98	17900.	135.	3204.
99	17651.	121.	3068.
100	17411.	108.	2938.
SUM			458068.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12826.	12732.	11439.	6344.	458068.
INCHES		2.64	9.50	15.81	15.85
AC-FT		6317.	22700.	37770.	37876.

OVF

STATION 2

INFLOW I , OUTFLOW O AND OBSERVED FLOW *

	0.	10000.	20000.	30000.	40000.	50000.	0.	0.	0.	0.	0.	0.
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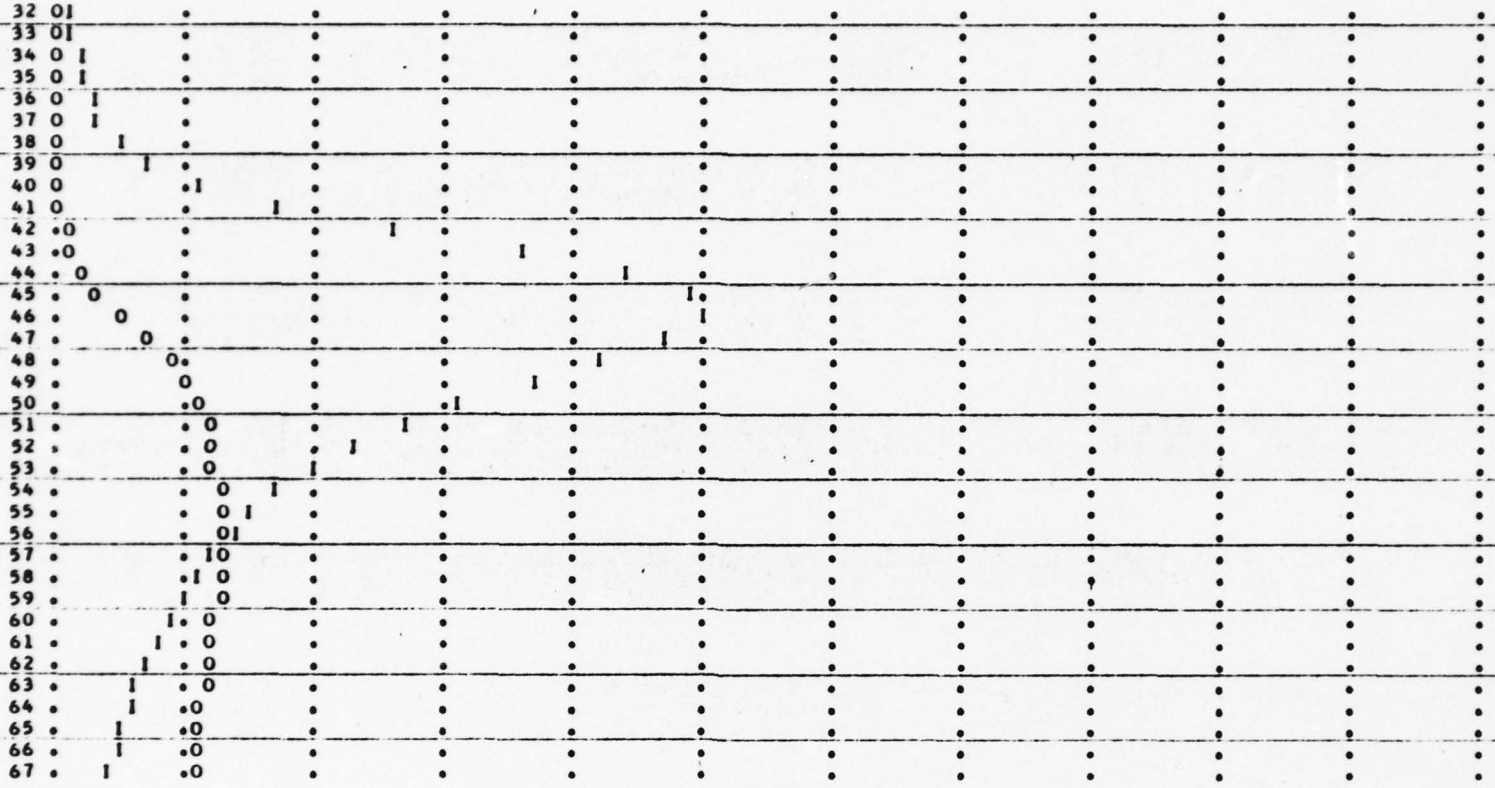
31	OI											


32 01
33 01
34 0 1
35 0 1
36 0 1
37 0 1
38 0 1
39 0 1
40 0 1
41 0 1
42 10
43 10
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45 1 0
46 1 0
47 1 0
48 1 0
49 1 0
50 1 0
51 1 0
52 1 0
53 1 0
54 1 0 1
55 1 0 1
56 1 01
57 1 10
58 1 1 0
59 1 1 0
60 1 1 0
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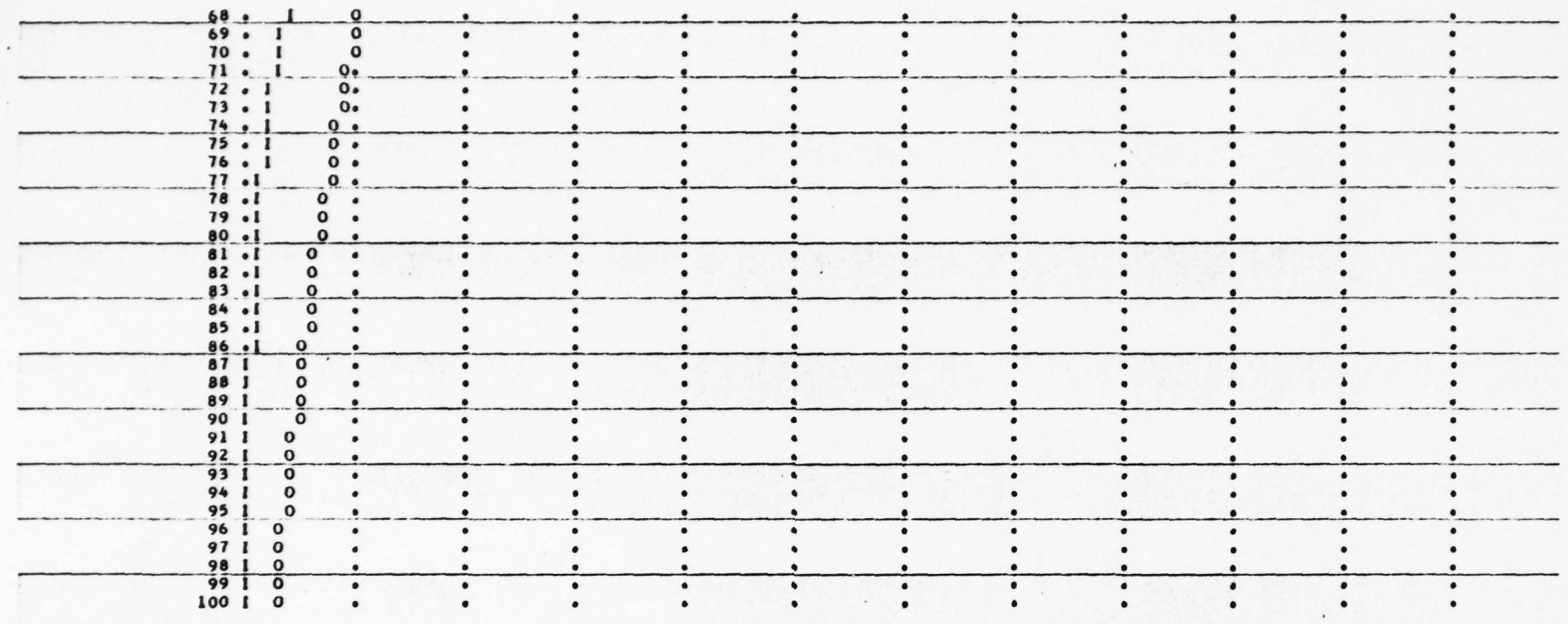
62 1 1 0
63 1 1 0
64 1 1 0
65 1 1 0
66 1 1 0
67 1 1 0


68 . I O
69 . I O
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95 I O
96 I O
97 I O
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99 I O
100 I O

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	50148.	45163.	23676.	9066.	44.80
ROUTED TO	2	12826.	12732.	11439.	6344.	44.80

APPENDIX C

PHOTOGRAPHS

Photograph Index

1. View showing deterioration of concrete apron downstream of concrete dam section.

2. Looking downstream from top of dam. Top of dam elevation is below the deck of the highway bridge.

3. Looking upstream from dam at immediate lake area.

4. Electric sluice gate hoist - right side sluice gate.

5. Upstream view of concrete overflow and sluice gate hoist.

6. Electric sluice gate hoist - leftside sluice gate.

7. Leftside sluice gate hoist and inlet.

8. Canal inlet for flow to power penstock at north end of lakes.

PLATE 1

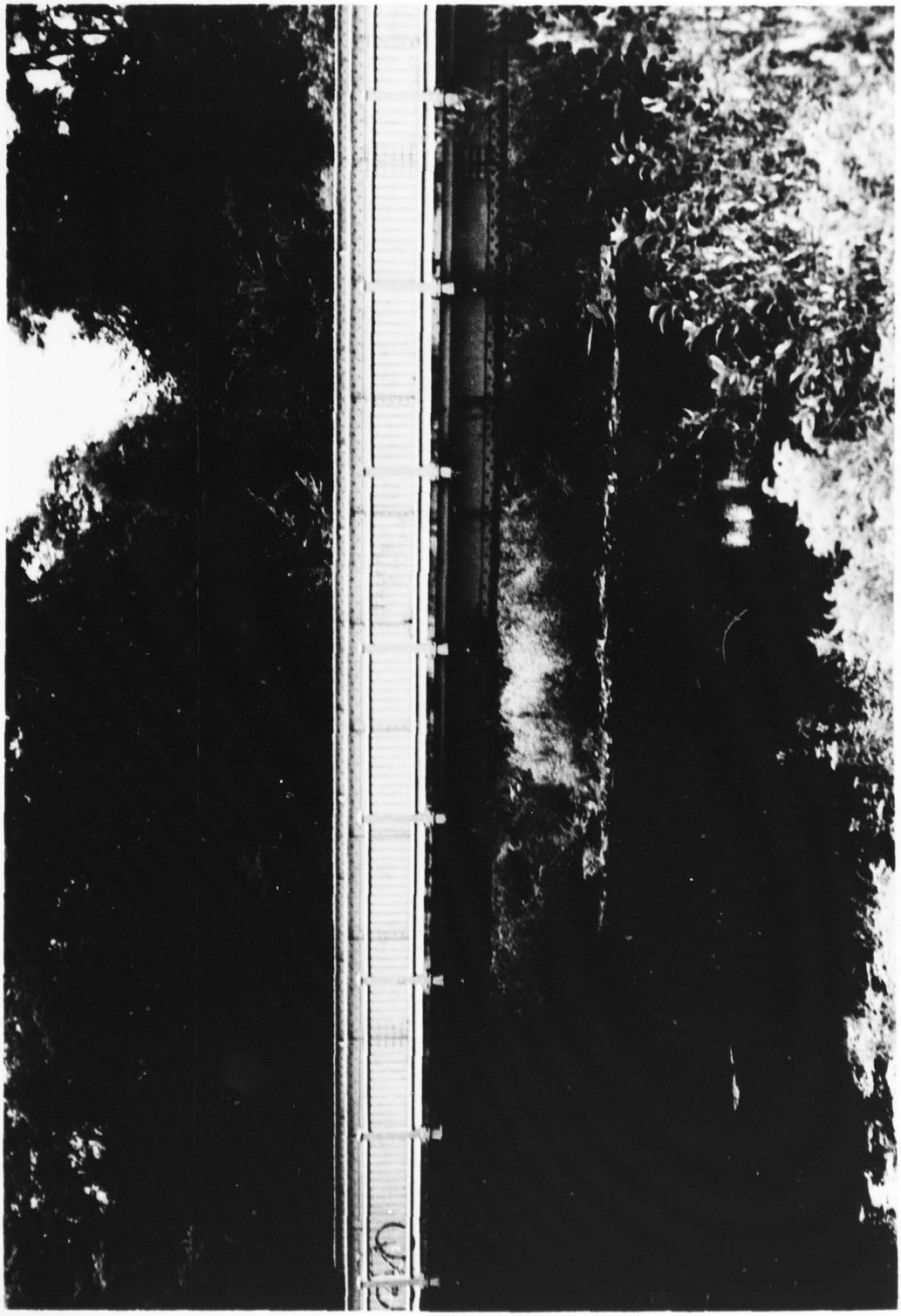


PLATE 2

PLATE 3

PLATE 4

PLATE 5

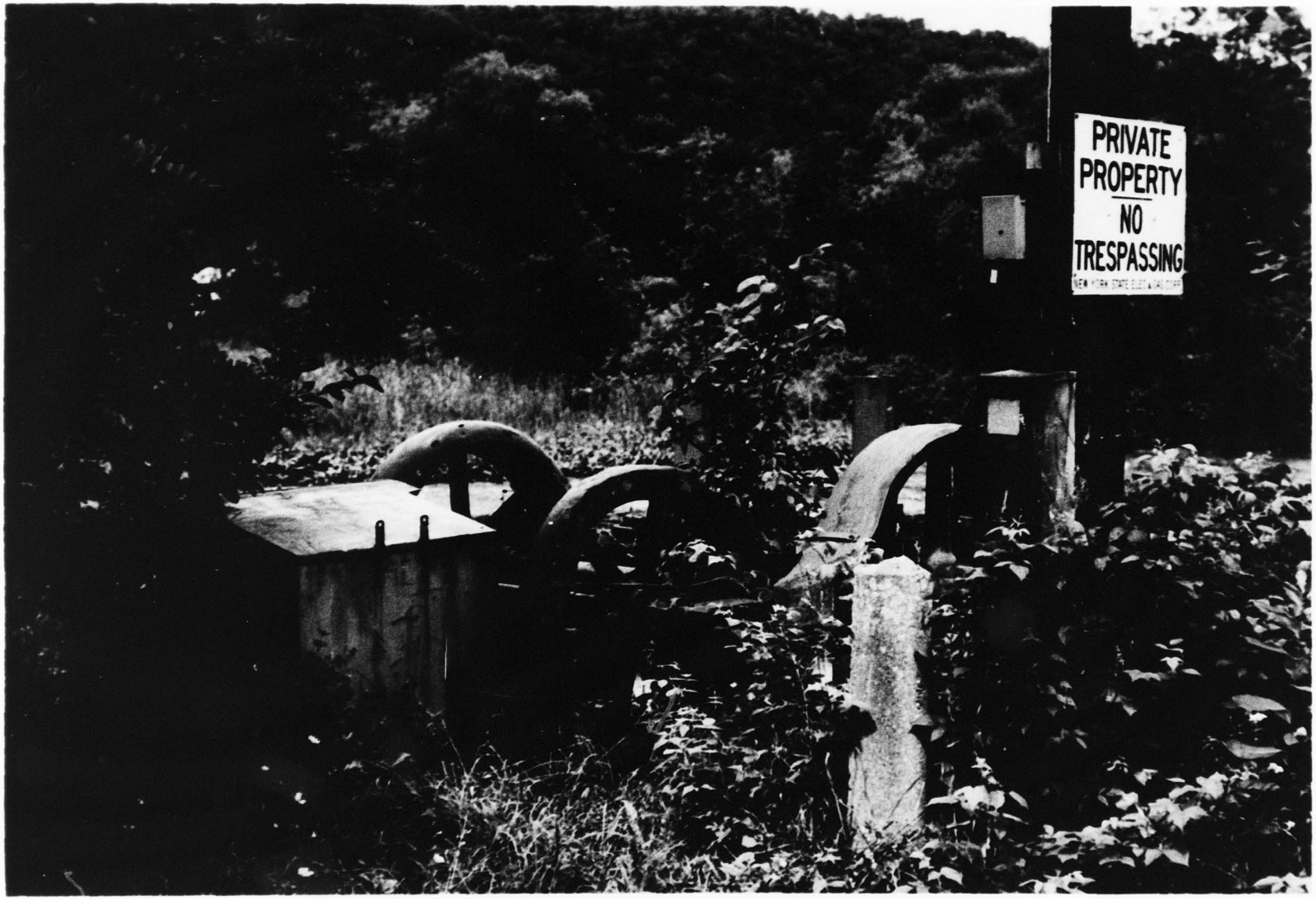


PLATE 6

PLATE 7

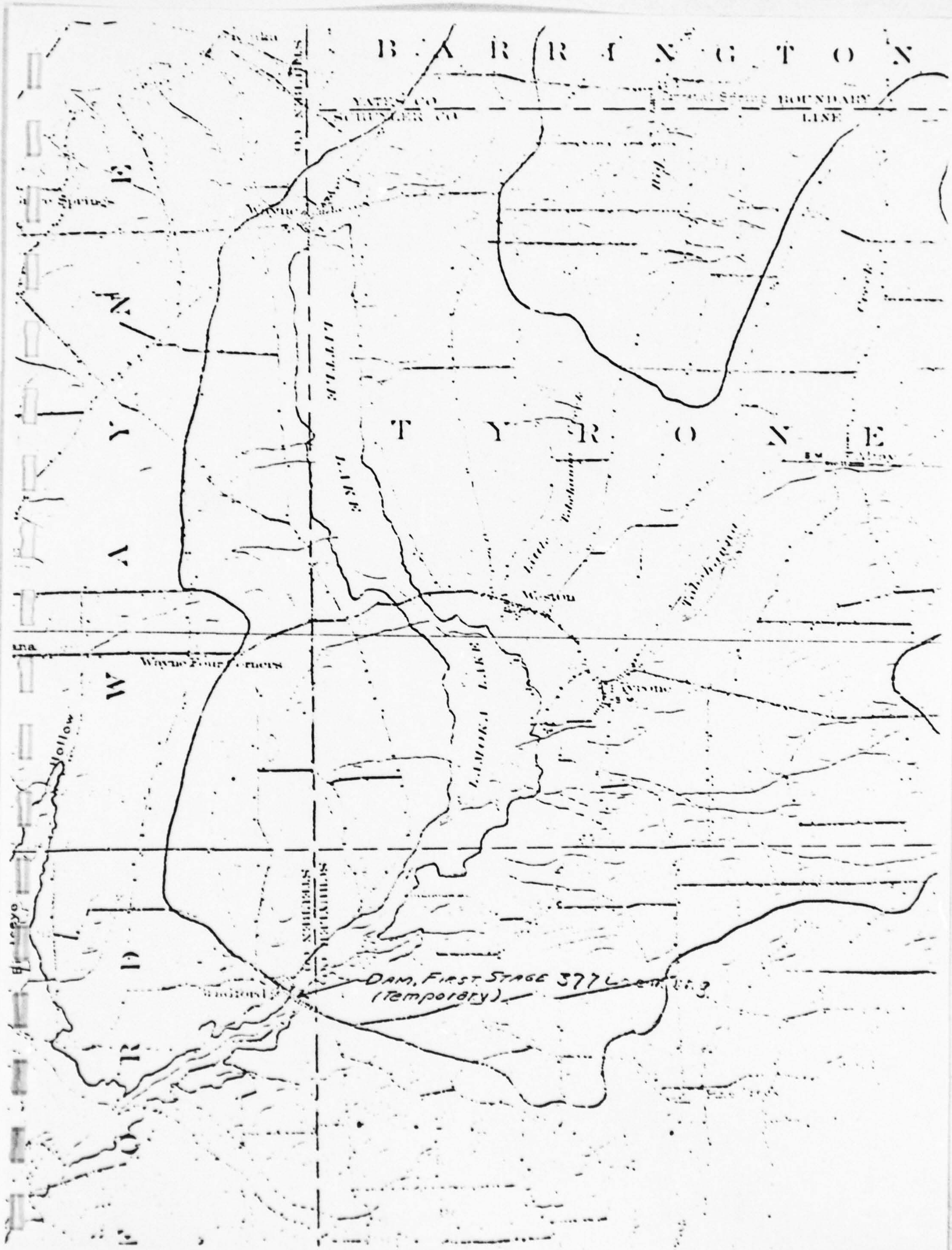
PLATE 8

APPENDIX D

PERTINENT CORRESPONDENCE AND REPORTS

Drawings on file

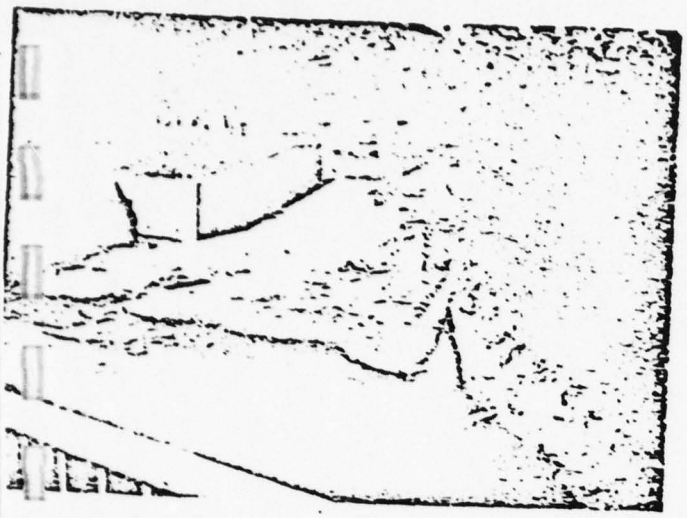
Drawing No 7	dated March 11-1926	587-2
" 8	" "	581-2
" 12	" "	591-2
" 6	" March 7-1926	586
" 8	" " Superseded	581
" 10	" "	590
" 16	" "	544
" 16A	" "	544-A
" 16B	" "	544-B
" 1	" "	592
" 2	" "	582
" 3	" "	583
" 4	" "	584
" 5	" "	585
" 6	" "	586
" 7	" "	587
" 8	" "	581
" 9	" "	596
" 10	" "	590
" 11	" "	597
" 12	" "	591
" 16	" "	544
" 17	" "	545
" 13		593
" 14		594
" 15		595
Telegram	" March 17-1926	1455
"	" "	1436
"	"	574
"	" Dec 4-1926	582-A
"	" "	


B A R R I N G T O N
YATES CO
SCHUYLER CO
BOUNDARY
LINE
Wayne
T Y R O N E
LITTLE
LAKE
LAMOKA LAKE
Weston
Wayne Four Corners
Tyrone
W A Y N E
D
R
O
Hollow
DAM, FIRST STAGE 377
(Temporary)

Dam 377 - Chemung at Bradford

Owned by Lamoka Power Corporation, Middletown

Plans on file in Map Filing Cabinet.



ENVIRONMENTAL CONSERVATION
ION REPORT
nspection)

nty	Hazard Class	Date & Inspector
hi	C	5/27/77

=16w Y. Estate Electric + Gas

Use

- ☐ Water Supply
- ☒ Power Abandoned
- ☒ Recreation - ☒ High Density
- ☐ Fish and Wildlife
- ☐ Farm Pond
- ☐ No Apparent Use-Abandoned
- ☐ Flood Control
- ☐ Other _____

☐ Stone
☐ Timber
☐ Other _____

Estimated Impoundment Size 2200 Acres ### Estimated Height of Dam above Streambed 1/. Ft.

Condition of Spillway

- ☒ Service satisfactory
- ☐ In need of repair or maintenance
- ☐ Auxiliary satisfactory
- ☐ In need of repair or maintenance

Explain: _____

Condition of Non-Overflow Section

- ☒ Satisfactory
- ☐ In need of repair or maintenance

Explain: _____

Condition of Mechanical Equipment

- ☐ Satisfactory
- ☐ In need of repair or maintenance

Explain: None

Siltation ☐ High ☐ Low

Explain: _____

Remarks: Apron is spalling & has cracks.

Evaluation (From Visual Inspection)

- ☐ Repairs req'd. beyond normal maint.
- ☒ No defects observed beyond normal maint.

Con...

...MENT OF ENVIRONMENTAL CONSERVATION
DAM INSPECTION REPORT
(By Visual Inspection)

Dam Number	River Basin	Town	County	Hazard Class	Date & Inspector
377	Clearing	Broadalbin	Steuben	C	5/27/77

Stream =

Owner = New York State Electric & Gas

Type of Construction

- [ ] Earth w/Concrete Spillway
- [ ] Earth w/Drop Inlet Pipe
- [ ] Earth w/Stone or Riprap Spillway
- [x] Concrete
- [ ] Stone
- [ ] Timber
- [ ] Other ______

Use

- [ ] Water Supply
- [x] Power Abandoned
- [x] Recreation - [x] High Density
- [ ] Fish and Wildlife
- [ ] Farm Pond
- [ ] No Apparent Use-Abandoned
- [ ] Flood Control
- [ ] Other ______

Estimated Impoundment Size 2200 Acres Estimated Height of Dam above Streambed 16 Ft.

Condition of Spillway

- [x] Service satisfactory
- [ ] In need of repair or maintenance
- [ ] Auxiliary satisfactory
- [ ] In need of repair or maintenance

Explain: ______

Condition of Non-Overflow Section

- [x] Satisfactory
- [ ] In need of repair or maintenance

Explain: ______

Condition of Mechanical Equipment

- [ ] Satisfactory
- [ ] In need of repair or maintenance

Explain: None

Siltation [ ] High [ ] Low

Explain: ______

Remarks: Apron is spalling & has cracks.

Evaluation (From Visual Inspection)

- [ ] Repairs req'd. beyond normal maint.
- [x] No defects observed beyond normal maint.

New York State Department of Environmental Conservation

MEMORANDUM

TO: Robert Drew

FROM: George Van Etten

SUBJECT: Bradford Dam - Department of Transportation #377, Steuben County, Chemung River Basin

DATE: August 14, 1972

An inspection was made of the Bradford dam on August 10, 1972, while I was in the immediate area conducting a Flood Damage Survey with the Corps of Engineers. We had received verbal reports that this particular dam had failed during the flood so I was interested to see just how badly it had been damaged.

We found the dam in good condition with no signs of damage caused by the flood. The spillway apron shows wear and should be resurfaced, but the concrete dam itself appears structurally sound. In talking with the Superintendent of Highways, James Elliott, we were informed that New York State Gas and Electric had opened the two 5' X 6' sluice gates to relieve the pressure on the dam. The water rose to within 5 inches of the non-overflow portion of the structure but did not overtop it. Very little damage was caused immediately downstream to Mud Creek.

I feel that no further inspection by our Department is needed as there is not enough evidence to declare this structure unsafe.

GAVE/gd

Division of Resource Management Services
Bureau of Water Regulation

September 1, 1972

Mr. F. Howard Hurlbut
Chairman
Steuben County Board of Supervisors
County Office Building
Bath, New York 14810

Dear Mr. Hurlbut:

Mr. John G. Copley, Chairman, Chemung River Basin, Regional Water Resources Planning Board, has forwarded a copy of your Board's resolution dated August 9, 1972, requesting that an inspection be made of the "Bradford Dam" in the Town of Bradford, Steuben County.

In conjunction with the Department's work in the western part of the State concerning damaged facilities caused by Hurricane Agnes, an inspection was made of the subject dam by one of our Dam Safety Inspectors on August 10, 1972. The results of this inspection indicate that there was no apparent structural damage caused by the high water conditions and that the dam did not overtop during the storm. Furthermore, no washouts or serious erosion were evident and we therefore, do not plan to make any additional inspections of this dam at this time.

We should point out that the responsibility for the maintenance and operation of this dam lies with the New York State Electric and Gas Corporation and it would be the responsibility of that Corporation to carry out a more detailed engineering inspection and study if the Corporation felt such a study was warranted.

Thank you for calling this matter to our attention.

Very truly yours,

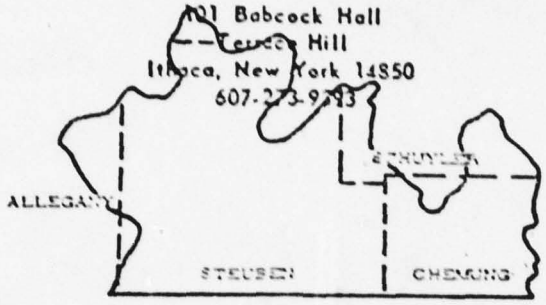
Robert S. Drew
Central Permit Agent

RSD:ls
cc: Dr. W. Lawrence
Mr. J. Copley
Mr. F. Davenport
Mr. E. Farath

CHEMUNG RIVER BASIN

Regional Water Resources Planning Board

101 Babcock Hall
Cornell Hill
Ithaca, New York 14850
607-273-9393



August 18, 1972

Mr. Robert Drew
Water Regulation Unit
Department of Environmental Conservation
50 Wolf Road
Albany, New York

Dear Mr. Drew:

Enclosed is a copy of a Resolution which we have received from the Steuben County Board of Supervisors on the safety of Bradford Dam.

We request that inspection of this structure be carried out as soon as possible and that a copy of the ensuing report be filed with us and the Board of Supervisors.

Your prompt attention to this matter will be appreciated.

Sincerely yours,

John G. Copley

John G. Copley, Chairman

JGC:FSD:jb

AUG 72 1: 4.

8/9/72

STEUBEN COUNTY BOARD OF SUPERVISORS
BATH, NEW YORK

Date Adopted 8/9/72
Amended
Tabled

Introduced by ~~Simpson~~ & Hauryski Seconded by Stowell

Vote -- Roll Call [X]: Acclamation [ ]: Tabled [ ]: Amended [ ]:

Ayes 31 Noes ____ Abstained ____ Absent 3

Title:

RESOLUTION REQUESTING THE CHEMUNG RIVER BASIN REGIONAL WATER RESOURCES PLANNING BOARD TO SEEK THE COOPERATION OF THE NEW YORK STATE ELECTRIC AND GAS CORPORATION, THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, AND THE APPROPRIATE FEDERAL AGENCIES TO INSTITUTE A SURVEY AND STUDY OF THE BRADFORD DAM IN THE TOWN OF BRADFORD, STEUBEN COUNTY, NEW YORK, In pursuance of State and Federal Laws applicable to the matter.

WHEREAS, the "Bradford Dam" located in the Town of Bradford is a water shed control structure involving the water shed area from Waneta Lake, Lamoka Lake, and Mud Creek flowing into the Cohocton River at Savona, New York, and

WHEREAS, the New York State Electric and Gas Corporation, to the best of the knowledge and belief of this Steuben County Board of Supervisors is involved in the use and structure of said "Bradford Dam", and

WHEREAS, the flood waters of the June, 1972 floods in Steuben County created a "major disaster" and the people of the community of the Town of Bradford and the Officials of the County of Steuben expressed great concern and anxiety regarding the structural stability and safety of said "Bradford Dam" during the tremendous flooding period caused by Hurricane Agnes, and

WHEREAS, the Steuben County Water Resources Committee believes that as a result of the June, 1972 floods in the County of Steuben and the enormous flooding condition at and around the "Bradford Dam", there should be instituted a survey and study of the structural stability and safety of said Dam, now therefore, be it

8/7/72 1:4

RESOLVED, that this Steuben County Board of Supervisors does hereby urgently requests that the Chemung River Basin Regional Water Resources Planning Board immediately take all necessary steps in seeking the cooperation and securing action from the New York State Electric and Gas Corporation, the New York State Department of Environmental Conservation, the New York State Department of Transportation and Civil Defense, and the appropriate Federal Agencies in commencing and completing a thorough survey, appraisal, study, and report relative to every material fact and aspect as to the structural stability, location, sufficiency of size, flood control, engineering design, and overall safety of the said "Bradford Dam" in the Town of Bradford, and be it further

RESOLVED, that the Clerk of this Board shall forward certified copies of this resolution to the New York State Electric and Gas Corporation; to the New York State Department of Environmental Conservation at its offices in Albany, New York and Avon, New York; to the New York State Department of Transportation at its offices in Albany, New York and Hornell, New York; to Mr. John G. Copley, Chairman of the Chemung River Basin Regional Water Resources Planning Board; to Mr. Theodore Markham, Steuben County Extension Agent; to Mr. Robert A Reed, Steuben County Highway Superintendent; to Mr. Jack Kahabka, District Conservationist; to the Steuben County Planning Director; and to Mr. Frank Davenport, Regional Director of said Chemung River Basin Regional Water Resources Planning Board.

State of New York } ss.
COUNTY OF STEUBEN

I, the undersigned, Clerk of the Board of Supervisors of said County, DO HEREBY CERTIFY, that the foregoing is a copy of a resolution duly adopted by said Board of Supervisors while in session in the Supervisors' Chambers in the Village of Bath, N. Y., AUG 9 1972, 19....; that it is a correct transcript therefrom and of the whole of said original.

IN TESTIMONY WHEREOF, I have hereunto set my hand and the seal of the said Board of Supervisors at Bath, N. Y., AUG 9 1972, 19....

Clerk

F-317 Che

Form W51. 5-12-16-2000 (16-16756) Acc. 382

(NOTICE: After filling out one of these forms as completely as possible for each dam in your district, return it at once to the Conservation Commission, Albany.)

STATE OF NEW YORK

CONSERVATION COMMISSION

ALBANY

DAM REPORT

June 12 (Date), 1912

CONSERVATION COMMISSION,

DIVISION OF WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as the Bradford Mill Dam.

This dam is situated upon the Mud Creek (Give name of stream)

in the Town of Bradford, Steuben County,

about ¼ mile (State distance) from the Village or City of Bradford

The distance down (Up or down) stream from the dam, to the Bradford Bridge (Give name of nearest important stream or of a bridge),

is about 100' (State distance).

The dam is now owned by Mulka Power Co. Corning N.Y. (Give name and address in full)

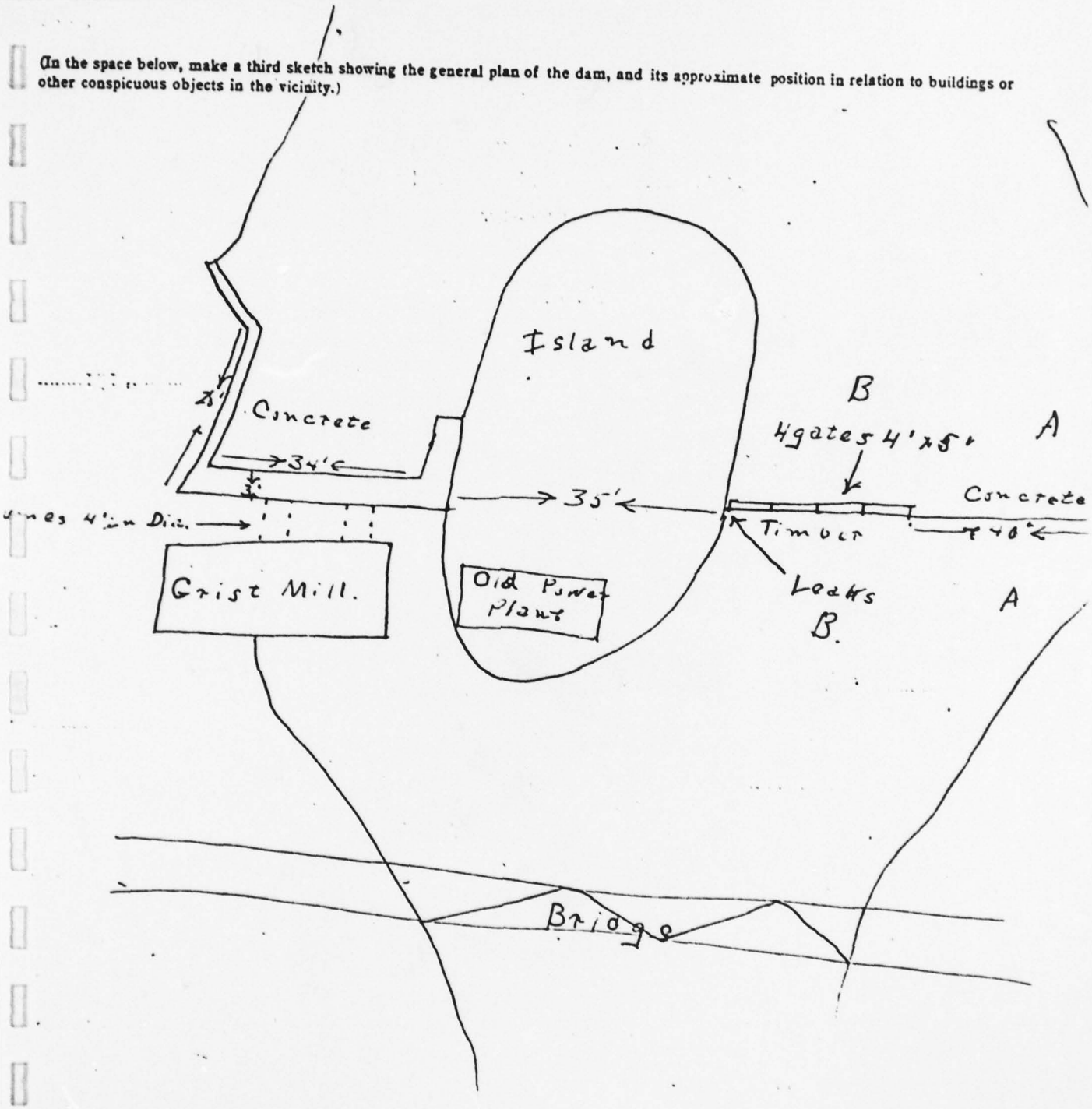
and was built in or about the year 1870, and was extensively repaired or reconstructed during the year 1903.

As it now stands, the spillway portion of this dam is built of Concrete (State whether of masonry, concrete or timber)

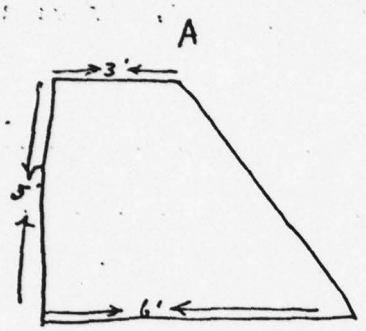
and the other portions are built of Concrete (State whether of masonry, concrete, earth or timber with or without rock fill)

As nearly as I can learn, the character of the foundation bed under the spillway portion of the dam is Gravel and under the remaining portions such foundation bed is Gravel.

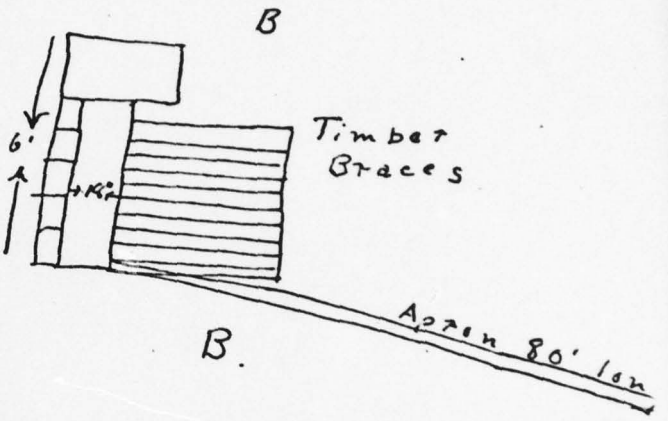
(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings or other conspicuous objects in the vicinity.)



(In the space below, make one sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam and outline the abutment, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the greatest height of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)



Section thru Concrete A



B.

The total length of this dam is 130 feet. The spillway or waste-weir portion, is about 26 feet long, and the crest of the spillway is about ..... feet below the abutment.

The number, size and location of discharge pipes, waste pipes or gates which may be used for drawing off the water from behind the dam, are as follows: 4 gates 4'x5'

At the time of this inspection the water level above the dam was ..... ft. ..... in. below / above the crest of the spillway.

(State briefly, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly any leaks or cracks or erosions which you may have observed.)

Dam is in fairly good condition. Leaks a little

Reported by Paul J. Callender
(Signature)

903 Glenn Ave
(Address—Street and number, P. O. Box or R. F. D. route)

Syracuse N.Y.
(Name of place)

8-34-1000 (C-1905)

STATE OF NEW YORK
DEPARTMENT OF
State Engineer and Surveyor
ALBANY

Received Feb 19th 1925 Dam No. 377 Chemung Watershed

Disposition Approved March 7-1925 Serial No. 607,678
March 11-1926

Foundation inspected

Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed drawings, marked Lamoka Power Corporation, Wayne-Keuka Power, Drawings No. 1 to 17 (inclusive).

herewith submitted for the { construction / reconstruction } of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about September 1, 1925. (Date)

1. The dam will be on Mud Creek, flowing into Cohocton River in the town of Bradford, County of Steuben and 160 feet upstream (west) from the crossroad leading from Tyrone to Savona N. Y. (Give exact distance and direction from a well-know bridge, dam, village main cross-roads or mouth of a stream)

2. The name and address of the owner is Lamoka Power Corporation, Corning, N. Y.

3. The dam will be used for Impounding and storing water for development of Power.

4. Will any part of the dam be built upon or its pond flood any State lands? No.

5. The watershed at the proposed dam draining into the pond to be formed thereby is 44.8 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 2,200 acres and will impound 2,841,960,000 cubic feet of water. with 10 feet draft.

7. The lowest part of the natural shore of the pond is about 5 feet vertically above the spillcrest, and everywhere else the shore will be at least 6 to 65 feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was 745 cubic feet per second at Savona on May 25, 1919 (Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam None-Property that might possibly be effected owned by the Lamoka Power Corporation

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) Hard pan.

11. The material of the right bank, in the direction with the current, is hard pan.; at the spillcrest elevation this material has a top slope of four (4) inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of 17 feet, and the top surface extends for a vertical height of 3 feet above the spillcrest.

12. The material of the left bank is Hard pan.; has a top slope of 4 inches to a foot horizontal, a thickness of 17 feet, and a height of 3 feet.

13 State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc.—hard pan, impervious to water; no apparent effect from exposure to the air; very uniform.

14. If the bed is in layers, are the layers horizontal or inclined? Horizontal. If inclined what is the direction of the horizontal outcropping relative to the axis of the main dam and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping:

15. What is the thickness of the layers? 3 to 15 feet.

16. Are there any porous seams or fissures? None have been found.

17. WASTES. The spillway of the above proposed dam will be 52 feet long in the clear; the waters will be held at the right end by a concrete core dam, the top of which will be 3 feet above the spillcrest, and have a top width of 2 feet; and at the left end by a concrete core dam, the top of which will be 3 feet above the spillcrest, and have a top width of 2 feet.

18. There will be also for flood discharge two pipes 48 inches inside diameter and the bottom will be 12 feet below the spillcrest, a sluice or gate (no sluice or gate) feet wide in the clear by feet high, and the bottom will be feet below the spillcrest.

19. APRON. Below the proposed dam there will be an apron built of planking, 52 feet long across the stream, 20 feet wide and 2 inches thick. The downstream side of the apron will have a thickness of 2 inches for a width of 20 feet.

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings in triplicate of the proposed structure, one set of which will be returned if they are approved. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape,

the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the dam.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the application any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer. State the assumed ice and uplift pressures and the conditions on which based.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back of this application make a sketch to scale for each different cross-section at the highest point; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillcrest; and outline the apron. Also sketch an elevation of each end of the dam with a cross section of the banks, giving the depth and width excavated into the banks.

22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at the ends of the spill; of the spillcrest for the above proposed dam; and of the spillcrest of any adjacent dams.

23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over $\frac{1}{4}$ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. INSPECTION. State how inspection is to be provided for during construction.....

.....

25. WATER SUPPLY. Are the waters impounded by the above dam to be used for a public water supply? No.... Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y.?

Attached to this application is a detailed report (as revised October 24, 1924) of the proposed Lamoka Power Corporation's Project.. As will be seen, the work is divided into five stages, of which the dam and spillway reported upon in this application blank form a part of the "First Stage", so-called.

In addition to the dam and spillway this first stage embraces the following:

The channel between Lamoka Lake and Little Lake is to be straightened and cleaned, to facilitate the flow of water.

An earth canal, designated as the Wayne-Keuka Power Canal, is to be constructed from the westerly end of Little Lake to a point 1.9 miles northwesterly, its northern end to be widened into a forebay 1,000 feet long and 300 feet wide. The canal is to be 15 feet wide and 8 feet deep, its bottom to be 5 feet below the present level of Little Lake.

Headworks are to be constructed at Wayne to final capacity, 600 second-feet. Pressure pipe line, of wood stave and steel construction, is to be installed from the forebay to a point on the shore of Lake Keuka, nea Keuka Landing, and a power house is to be built at this point.

The capacity of pipe line is to be 300 second-feet. The pipe line is to be of the following dimensions; 66 inches, inside measurement, at the upper end, tapering to 48 inches, inside measurement, at the entrance to th power house, the outlet of the pipe lines.

The power house is to be of one half ultimate size, and to be equipped with its first unit, one 4,000 horse-power hydraulic and electric unit.

As will be seen by perusal of the attached reports the within mentioned dam and spillway will be for temporary purposes.

The second, third, fourth and fifth stages of this development are out-lined in the reports attached hereto.

The canal bottom will be at an elevation of about 1092 ft. at the Little Lake end. The present level of Little Lake is about 1099 ft. The dam will raise this level to about 1102 ft., with a spillway crest at 1102 ft.

The above information is correct to the best of my knowledge and belief.

Corning, New York
(Address of signer)

LAMOKA POWER CORPORATION

February 18, 1925.
(Date)

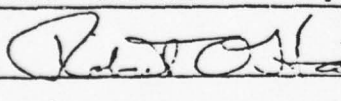
By Robert O Hart Engineer
(A person signing for owner should indicate his title or authority)

SECTION 948 OF THE CONSERVATION LAW

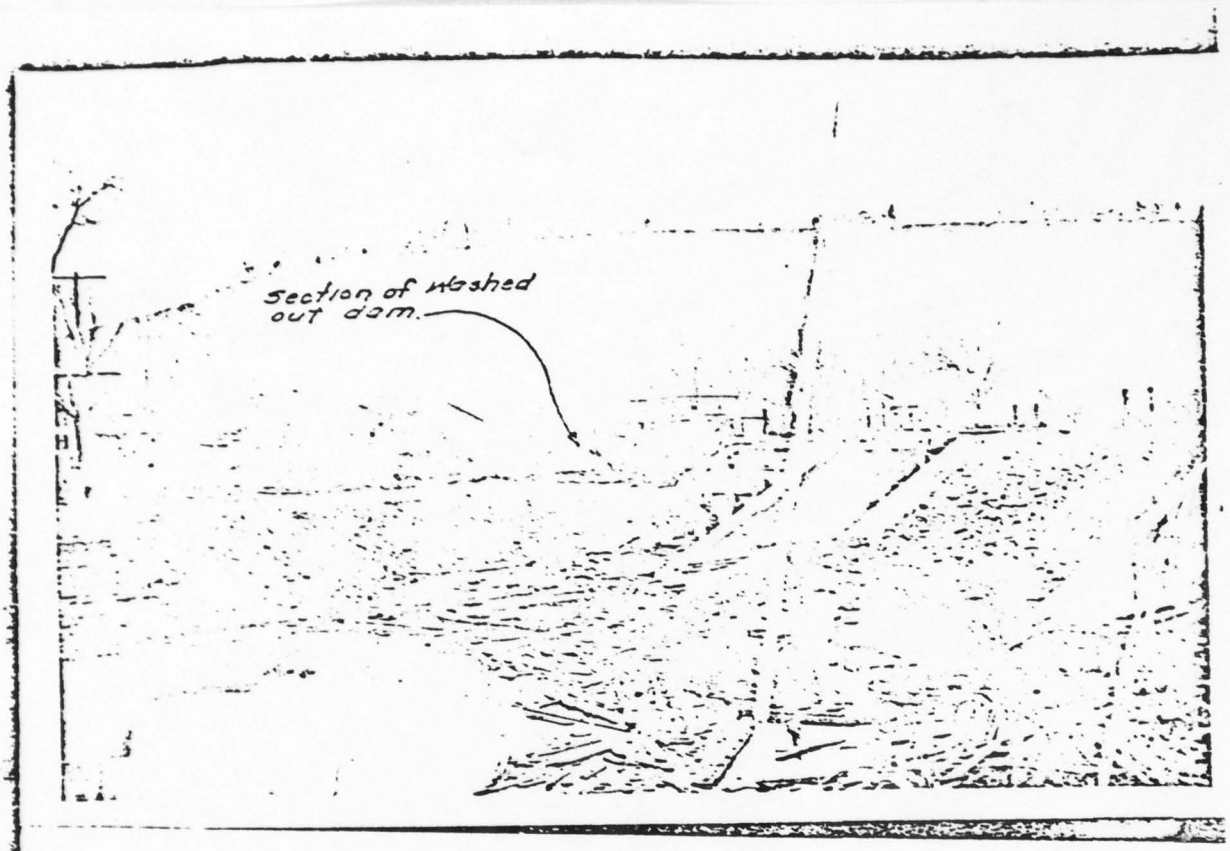
§ 948. **Structures for impounding water; inspection of docks; penalties.** No structure for impounding water and no dock, pier, wharf or other structure used as a landing place on waters shall be erected or reconstructed by any public authority or by any private person or corporation without notice to the superintendent of public works, nor shall any such structure be erected, reconstructed or maintained without complying with such conditions as the superintendent of public works may by order prescribe for safeguarding life or property against danger therefrom. No order made by the superintendent of public works shall be deemed to authorize any invasion of any property rights, public or private, by any person in carrying out the requirements of such order. The superintendent of public works shall have power, whenever in his judgment public safety shall so require, to make and serve an order directing any person, corporation, officer or board, constructing, maintaining or using any structure hereinbefore referred to, remove, repair or reconstruct the same within such reasonable time and in such manner as shall be specified in such order, and it shall be the duty of every such person, corporation, officer or board, to obey, observe and comply with such order and with the conditions prescribed by the superintendent of public works for safeguarding life or property against danger therefrom, and every person, corporation, officer or board failing, omitting or neglecting so to do, or who hereafter erects or reconstructs any such structure hereinbefore referred to without submitting to the superintendent of public works and obtaining his approval of plans and specifications for such structures when required so to do by his order or who hereafter fails to remove, erect or to reconstruct the same in accordance with the plans and specifications so approved shall forfeit to the people of this state a sum not to exceed five hundred dollars to be fixed by the court for each and every offense; every violation of any such order shall be a separate and distinct offense, and, in case of a continuing violation, every day's continuance thereof shall be and be deemed to be a separate and distinct offense. This section shall not apply to a dam where the area draining into the pond formed thereby does not exceed one square mile, unless the dam is more than ten feet in height above the natural bed of the stream at any point or unless the quantity of water which the dam impounds exceeds one million gallons; nor to a dock, pier, wharf or other structure under the jurisdiction of the department of docks, if any, in a city of over one hundred and seventy-five thousand population. This section as hereby amended shall not impair the effect of an order heretofore made by the conservation commission or commissioner under this section prior to the taking effect of chapter four hundred and ninety-nine of the laws of nineteen hundred and twenty-one, nor require the approval by the superintendent of public works of plans and specifications heretofore approved by such commission or commissioner under this section.

The foregoing information and accompanying plans and specifications are correct to the best of my knowledge and belief.

Keuka Lake Power Corporation, Owner

By  authorized agent of owner.

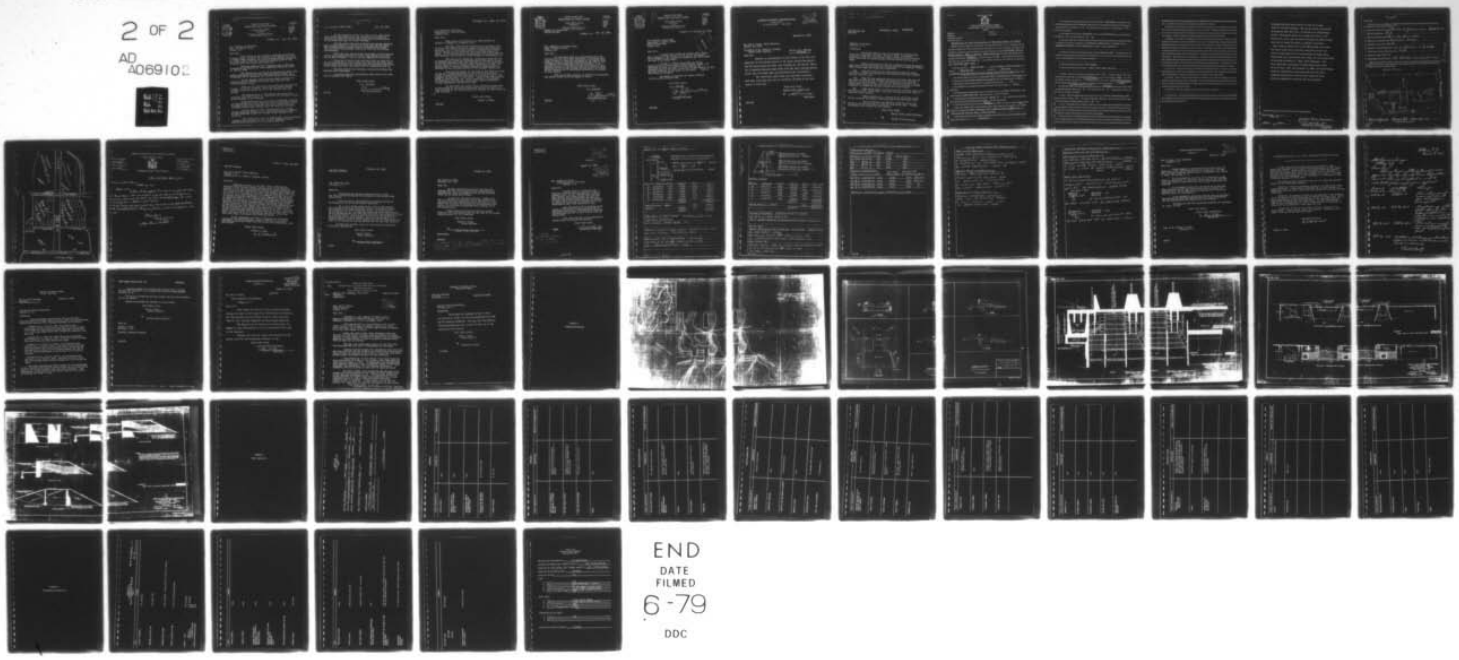
Address of signer Corning, New York Date February 24, 1936.



Works of

AD-A069 102 KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA F/G 13/2
NATIONAL DAM SAFETY PROGRAM. BRADFORD DAM (INVENTORY NUMBER NY---ETC(U)
SEP 78 R J KIMBALL DACW51-78-C-0025
UNCLASSIFIED NL

2 OF 2
AD A069102



END
DATE FILMED
6-79
DDC

SIXTH DISTRICT

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

FRED K STUART GREENE
SUPERINTENDENT

OSBORNE J DEMPSTER, DIST. ENG.
No. 30 WEST MAIN ST., HORNELL N.Y.

COUNTIES IN 6TH DISTRICT
ALLEGANY
CHEMUNG
SCHUYLER
STEUBEN
TIOGA
YATES

HORNELL, N.Y., Mar. 12, 1936

T.F. Farrell, Chief Engr.,
Dept. of Public Works,
Albany, N.Y.

Dear Sir:-

This refers to the headworks situated in Bradford, Steuben County, formerly the property of a corporation known as Lamoka Power Company, now having passed through reorganization and under a name that cannot be certainly stated but believed to be the "Keuka Lake Power Co."

You have asked us for a report on the conditions surrounding the washout of these headworks during the flood of July 8, 1935.

The information in regard to this has not been altogether consistant and we have been delayed by changes in assignment due to emergency and washout bridge construction.

We are sending under separate cover a tracing to which we wish to refer and which we hope will make the situation clear to you.

Prior to the flood there was a dam and reservoir at Tyrone, "A" on the tracing. From this the runoff passed through a natural channel shown on the tracing into Lake Lamoka.

The natural flow of Lake Lamoka was toward the south but this was blocked at Bradford by the headworks shown in some detail on the tracing.

These headworks and earth dam at Bradford served to reverse the flow of Lake Lamoka so that it discharged toward the north into Little Lake and from this a power canal led to Keuka on Lake Keuka (canal route not shown on tracing).

On the night of July 7th-8th the dam at Tyrone failed completely about 4 A.M., allowing the entire contents of this reservoir runoff as rapidly as the channel would carry it.

This caused the level of Lake Lamoka to rise somewhat gradually and the crest of the flood at Bradford was not reached until possibly 12 M. on Monday, July 8th.

T.F. Farrell, Chief Engr. Mar. 12, 1936

In the headworks shown, the two 4' x 6' gates shown were thrown open about 1 A.M. of July 8th but it was not possible to raise the power gate, called open sluiceway gate, in the wheel pit near "C" on the tracing.

The two gates that were open did not provide anywhere near enough capacity to handle the flood flow and the earth dam extending northwesterly from the headworks was washed out leaving an open channel located at "C-D" on the tracing accompanying.

This area was washed deeper than shown by the contours on the map accompanying but has since been filled in and the dam in part restored. Work is now in progress at this point.

There was a wheel house over the wheel pit near "C" on the tracing and about 4 P.M. after the crest of the flood had passed this wheelhouse was carried away and demolished the steel truss bridge on county road about 150 ft. downstream from it.

You will find on the tracing a corner map showing the drainage area concerned.

I am enclosing some photographs taken before this work now in progress was begun.

Very truly yours,

O.J. DEMPSTER

District Engineer

TFW.GK

Corning, N.Y., Sept. 24, 1935.

O.J. Dempster, Dist.Eng.,
Department of Public Works,
Hornell, N.Y.

Dear Sir:-

YOur letter of September 23, 1935 relative to washout of Bridge 44, Bradford, N.Y.

The Lake Keuka Power Corporation of Syracuse, N.Y., of which W.P. Gannon, Onondaga County Savings Bank Building, Syracuse, N.Y. is President, expects to acquire the assents of the Lamoka Power Corporation not later than October 21, 1935. At the present time the Corporation is in the hands of the receiver, who is one, Mr. Olif Tassell of Williamson, N.Y.

The washout of Bridge 44, immediately below the dam at Bradford was caused by the going out of the dam at Tyrone on the Big Tobehanna Creek and the Inability of the operatives of the Receiver of the Lamoka Power Corporation to open the sluice gates through a concrete headworks, which was built, cutting off the spillway section of the original Lamoka dam.

The original plans, as approved by the State Engineer, of Dam 377, Chemung-Bradford, as you will note from your files, provided spillway sufficient to have taken care of the overflow of July 8th, of this year. These plans were approved March 7, 1926 and also the time of completion was extended to November 1, 1927 and on August 24th, 1928 the time was further extended to November 1, 1929.

My work with the Lamoka Power Corporation terminated in the spring of 1930 and whether appr oval by the State was ever obtained to the reconstruction or changes of this structure, I do not know.

Yours very truly,

Robert O. Hayt.

ROH:GMM

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

FRED'K STUART GREENE
SUPERINTENDENT

OSBORNE J DEMPSTER, DIST. ENG.
No. 30 WEST MAIN ST., HORNELL, N. Y.

SIXTH DISTRICT

COUNTIES IN 6TH DISTRICT

ALLEGANY
CHEMUNG
SCHUYLER
STEUBEN
TIOGA
YATES

Washed Out Bridge #44
Steuben County

HORNELL, N. Y., Oct. 14, 1935

E.W. Wendell, Asst.Chief Engr.,
Dept. of Public Works,
Albany, N.Y.

Dear Sir:-

In connection with the construction of a new structure at the site above indicated, I recommend that steps be taken to make the headworks of the Lamoka Power Company or their successor satisfactory and such as not to endanger the bridge which we are building. I am sending a copy of a letter received from Robert O. Hayt, Engineer for the former owners, giving us all the information available as to the proper authorities to contact in this regard.

Will you kindly instruct us further if you desire any direct action by us in regard to this ?

Very truly yours,

O.J. DEMPSTER

O J Dempster

District Engineer

TFN.GK

SIXTH DISTRICT

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

FRED K STUART GREENE
SUPERINTENDENT

OSBORNE J DEMPSTER, DIST. ENG.
No. 30 WEST MAIN ST., HORNELL, N. Y.

COUNTIES
IN 6TH DISTRICT

ALLEGANY
CHEMUNG
SCHUYLER
STEUBEN
TIOGA
YATES

HORNELL, N.Y., October 21, 1935

T.F. Farrell, Chief Engr.
Department of Public Works,
State Office Bldg.
Albany, N.Y.

Dear Sir:-

We have your letter of October 14th. asking for a report on the failure of the dam of the Lamoka Power Company in the village of Bradford, and will submit the same at an early date.

We have a letter from Walter M. Mills, Superintendent for the Lamoka Power Company, Keuka, N.Y. informing us that he wishes to start work on the reconstruction in the near future and we have written to him that your approval of his plans is necessary. Copy of our letter is attached.

We expect to forward the report referred to on or about October 26hh.

Very truly yours,

O.J. DEMPSTER

O J Dempster

DISTRICT ENGINEER.

TFN:KSG

LAMOKA POWER CORPORATION

HUDSON TERMINAL

50 CHURCH STREET NEW YORK

December 8, 1926.

Mr. Roy G. Finch, State Engineer,
Albany, New York.

Attention of Mr. Frank R. Lanagan,
Deputy State Engineer.

Dam No. 377, Chemung
Bradford

Dear Sir:

Receipt is acknowledged of your letter of the 4th inst. addressed to the Corning office of the above Corporation approving the construction as shown upon tracings No. 574 and No. 586-A, for a temporary Penstock Head Works from the canal running between Little Lake and Keuka Lake and authorizing the construction.

The conditions under which your approval is granted have been noted and they will be carefully followed in the execution of this work.

Yours very truly,
LAMOKA POWER CORPORATION
By A. H. Tunnel,
Secretary.

AHT:ECH

December 4, 1926. ARMcK/ECH

Dam 577, Chemung
Bradford

Lamoka Power Corp.,
Corning, N. Y.

Gentlemen:

Acknowledgment is made of a letter of November 26th from your Consulting Engineer, Robert O. Hayt, enclosing 2 tracings marked file No. 574, and 506-A, for a temporary Penstock Head Works from the canal running between Little Lake to Mud Lake.

These tracings meet with the approval of this department and permission is given for the construction of a temporary Penstock Head Works, under the following conditions:

(1) That the wall of the head works be well and firmly fastened together, especially the connection between the woodwork and the concrete work.

(2) That the two vertical reinforcement bars each side of the Penstock pipe in the vertical reinforced concrete slab be carried down to the base. That an additional horizontal bar be placed just above the Penstock pipe and that two additional floor crossbars be placed in the slab below the Penstock pipe.

(3) That sheet piling be driven through both the wooden abutments opposite to and connected with the vertical concrete slab, in order to form a cutoff.

This approval is supplementary to and forms a part of our approval of March 7, 1926 extended to November 1st, 1927.

We are returning to Robert O. Hayt the above two tracings stamped with the approval of this department. Kindly acknowledge the receipt of this letter.

Yours very truly,

Roy C. Finch, State Engineer

By Deputy State Engineer.

6-5-27-500 (6-1928)

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENGINEERING
ALBANY

Received..... Dam No.....
Disposition..... Watershed.....
Foundation inspected.....
Structure inspected.....

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the Superintendent of Public Works, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended and amendatory laws for the approval of specifications and detailed drawings, marked Lamoka Power Corporation, Wayne-Keuka Power (Drawings Nos 128-15A-16C & 17A) herewith submitted for the { ~~construction~~ / reconstruction } of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about December 31st 1928 (Date)

1. The dam will be on Mud Creek flowing into Cohocton River at Savona in the town of Bradford, County of Steuben and 160ft Up-stream (West) from Cross-road leading from Tyrone to Savona, N.Y. (Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)

2. The name and address of the owner is Lamoka Power Corporation, Corning, N.Y.

3. The dam will be used for Impounding & storing Water for the development of Power

4. Will any part of the dam be built upon or its pond flood any State lands? No

5. The watershed at the proposed dam draining into the pond to be formed thereby is 44.8 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 1102.00 of 2,200 acres and will impound 2,841,960,000 cubic feet of water. with 10 ft. Draft

7. The lowest part of the natural shore of the pond is about 5 feet vertically above the spillcrest, and everywhere else the shore will be at least 6 to 65 feet above the spillcrest.

8. The maximum known flow of the stream at ~~Hammondsport~~ Savona was 74.5 cubic feet per second on May 25-1919 (Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam. None. Property which might possibly be effected is owned by the Lamok Power Corporation

10. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) Hard-pan

11. The material of the right bank, in the direction with the current, is Hard-pan; at the spillcrest elevation this material has a top slope of four (4) inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of 17 feet; and the top surface extends for a vertical height of 3 feet above the spillcrest.

12. The material of the left bank is Hard-pan; has a top slope of four (4) inches to a foot horizontal, a thickness of 17 feet, and a height of 3 feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. Hard-pan, impervious to water; no apparent effect from exposure to air; very uniform.

14. If the bed is in layers, are the layers horizontal or inclined? Horizontal. If inclined what is the direction of the horizontal outcropping relative to the axis of the main dam and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping.

15. What is the thickness of the layers? 3 to 15 feet.

16. Are there any porous seams or fissures? None have been found.

17. WASTES. The spillway of the above proposed dam will be 40 feet long in the clear; the waters will be held at the right end by a Timber & Pile Bulkhead with Earth Backfill the top of which will be 6.25 feet above the spillcrest, and have a top width of 1.5 feet; and at the left end by a Timber & Pile Bulkhead with Earth Backfill the top of which will be 6.25 feet above the spillcrest, and have a top width of 1.5 feet.

18. There will be also for flood discharge a ~~pipe~~ Reinforced Concrete Culvert 60 by 60 inches inside dimensions ~~diameter~~ and the bottom will be 13.75 feet below the spillcrest, a sluice or gate 5 feet wide in the clear by 5 feet high, and the bottom will be 12.5 feet below the spillcrest.

19. APRON. Below the proposed dam there will be an apron built of Timber, Piles & Planking 40 feet long across the stream, 31 feet wide and 4 inches ~~thick~~ thick. The downstream side of the apron will have a thickness of 4 inches ~~feet~~ for a width of 31 feet.

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings in triplicate of the proposed structure, one set of which will be returned if they are approved. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape,

the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the dam.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the application any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer. State the assumed ice and uplift pressures and the conditions on which based.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back of this application make a sketch to scale for each different cross-section at the highest point; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillcrest; and outline the apron. Also sketch an elevation of each end of the dam with a cross section of the banks, giving the depth and width excavated into the banks.

22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at the ends of the spill; of the spillcrest for the above proposed dam; and of the spillcrest of any adjacent dams.

23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over $\frac{1}{4}$ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. INSPECTION. State how inspection is to be provided for during construction.....

.....

25. WATER SUPPLY. Are the waters impounded by the above dam to be used for a public water supply? No. Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y.?

Accompanying this application are the following sets of working drawings, "Dam and Spillway at Bradford" Drawings No.16-C and 17-A. "Penstock Line, Wayne-Keuka Power", Drawing No.12-B, and "Keuka Lake Power House" Drawing No. 15-A, and the Superintendent of Public Works' Approval of these drawings is herewith requested.

For complete details as to the development with which the above plans are connected, reference is had to a previous application with accompanying drawings ,etc., filed under date of December 29, 1925, for the Lamoka Power Corporation by Robert O. Hayt, their Engineer. The State Engineer's Approval of these being under dates of March 7th, 1925, and December 4, 1926, and the drawings herewith submitted are modifications and with more complete construction details than those for which the State Engineer's approval has been granted.

The above information is correct to the best of my knowledge and belief.

Corning, N. Y.
(Address of signer)

Sept. 1927
(Date)

Lamoka Power Corporation
by Robert O. Hayt
(A person signing for owner should indicate his title or authority)
Engineer

Page 54

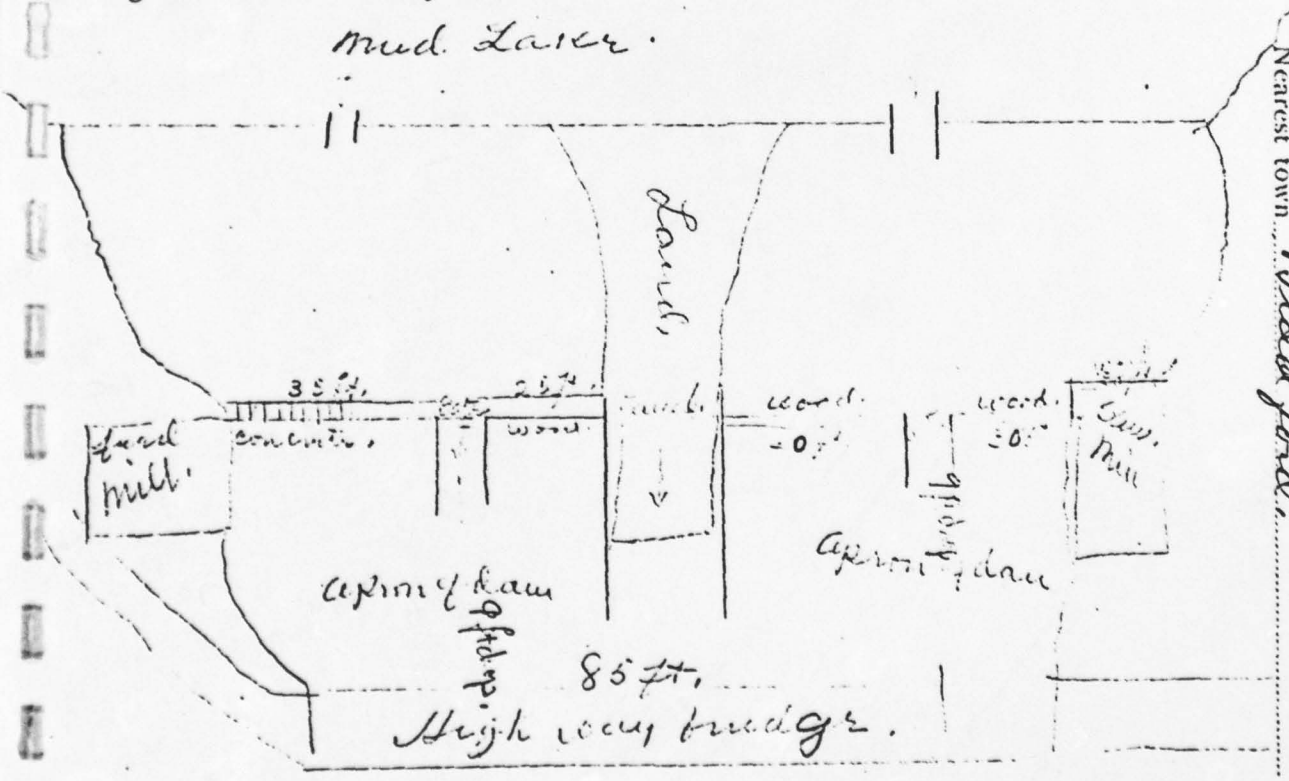
30-11 5000 (10-10652)

Fill out a form as complete as possible for each dam in your district and send to State Conservation Commission, Albany, N. Y.

1. Name and address of owners Gruden & Zimmerman. Bradford. Pa.
2. Date of construction 1906
3. Uses of impounded water Power for feed mill.
4. Character of foundation bed Concrete & wood.
5. Material of waste spill Wood.
6. Length of waste and depth below dam 100 feet long 10 ft deep.
7. Total length of dam including waste 75 ft.
8. Material of dam Wood.
9. Discharges, size and location 10 ft. 9 ft drop. at one side of the mill.

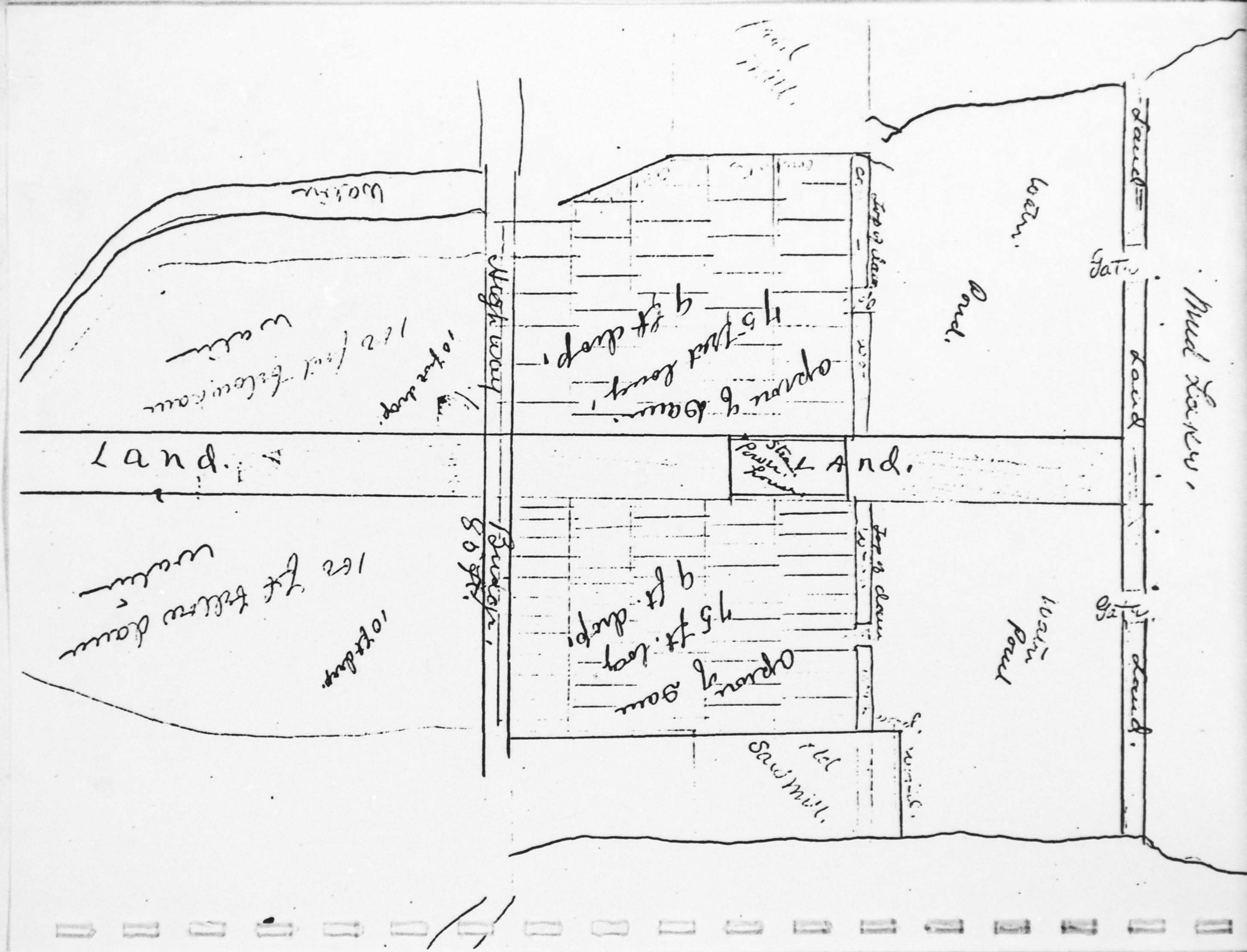
377 Chemung

Below sketch section of waste and section of dam, with greatest heights and top thickness and bottom thickness. On opposite side sketch general plan of dam and give distance from a bridge or from a tributary stream.



Carl A Zeeb. Painted Post. Feb. 28. 13.

(Signature, address and date.)


Land.
Land.
Highway
Bridge
80 ft.
Water
Water
Pond.
Water
Pond
Gate
Gate
Land
Land
Land
Mud Lake.
Saw Mill.

ADDRESS ALL COMMUNICATIONS TO THE CONSERVATION COMMISSION

STATE OF NEW YORK

CONSERVATION COMMISSION

GEORGE E. VAN KENNEN
CHAIRMAN
JAMES W. FLEMING
JOHN D. MOORE
COMMISSIONERS
ALBERT E. HOYT
SECRETARY
JOHN J. FARRELL
ASS'T SECRETARY

DIVISION OF FISH AND GAME
JAMES W. FLEMING
COMMISSIONER
THOMAS H. GUY
DEPUTY COMMISSIONER
DR. TARLTON H. BEAN
FISH CULTURIST
LLEWELLYN LEGGE
CHIEF GAME PROTECTOR

Painted Post. Mch 1. 1913.

Conservation Comm.
Albany. N.Y.

Dear sir.

While at Bradford. I made a rough sketch of the dam there. The wood part is quite old. and has quite a pressure behind it. above the dam. I should judge the water was all of 5 or 6 feet deep.

As to the map #55 you sent me. I could not find the Rath for on the Bradford dam. they are farther north & west from this map.

Resp Yours
Carl A Gueber.
State Game Protector

ROBERT O. HAYT
M. AM. SOC., C. E.
CONSULTING ENGINEER

CORNING, N. Y. Feb. 23,1925.

Dam 377 Chemung.

Mr. Roy G.Finch, State Engineer,
Albany, N.Y.
Attention of Mr. Frank R. Lanagan, Deputy.

Dear Sir :

Replying to yours of the 20th. inst. would say the elevation given in your letter, namely 1093.9 is not given on Drawing No. 16, but is practically correct by scale from water surface of Nov.19,1924. Elevation 1096.17 and present Stop Plank are in between 8" x 8" posts to hold the water surface from 2 to 2 1/2 feet above this. The elevation of the present spillway will not be changed excepting downstream end now hanging in the air will be supported with 6" x 8" timbers, sheet piling and stone filling as shown in Drawing No. 16. The posts and stop plank of spillway sections will be raised respectively to elevations 1102.00 and 1105.00 as shown. Of course the present dam leaked badly and much of the filling has been washed out. The 8" x 8" timbers in the BB Spillway section are spaced longitudinally 6.1 feet C to C . In the CC Section the spacing varies from 5'5" to 6'2" . The old timber work is framed with mortise and tennons pinned with wooden pins. The new work is to be connected with bolts, spikes and 5/8" drift pins, and filled with stone as shown.

We are enclosing with this a blueprint of additional tracing of the three sections shown on Drawing No. 16 with explanatory notes and trust this will supply the information that you require.

Yours very truly,

Robert O. Hayt.

Per S. T. Hayt Jr.

February 20, 1925.

Dam 377, Chemung

Mr. Robert C. Hayt,
Corning, N. Y.

Dear Sir:

Concerning the proposed reconstruction of dam No. 377, Chemung watershed, at Bradford for the Lanoka Power Corporation:

Can you give us more details of Sections BB and CC on drawing No. 16 so we may obtain stability?

In Section BB the crest of the deck of the present log crib spillway is at elevation 1093.9. The water is shown at a height of 2.5 feet above this crest. Is this the old flow line and, if so, did stop log plank hold it at that level? In the reconstruction will the stop plank run from elevation 1093.9 to elevation 1102? What are the dimensions of the present log crib dam and is it stone filled? How far down do the 3 x 8 timbers extend? What is their spacing and how are they fastened? What is the spacing of the new timbers and how are they fastened?

We will also require about the same general information concerning Section CC.

Very truly yours,

Roy G. Finch,
State Engineer

By_____
Deputy State Engineer.

ARH/F.

August 25, 1924.

Mr. Robert O. Hayt,
Corning, New York.

Dear Sir:

We have received your letter of August 22, stating that you are considering the construction of hydrographic works on Genesee river, on the Cohocton river and on Keuka Lake outlet.

We enclose application blanks. Kindly fill out as completely as possible one of the applications for each structure impounding water and submit to this office for approval to commence the construction work, making the sketches as requested under Section 21 of the application.

State what provisions are made for uplift pressure, for ice pressure and for the flow of the stream during erection of the structure.

Very truly yours,

Dwight B. LaDu,
State Engineer

By_____
Deputy State Engineer.

Enclosures.

ARMcK/F.

ROBERT O. HAYT
M. AM. SOC. C. E.
CONSULTING ENGINEER

CORNING, N. Y.

August 22, 1924.

Hon. Dwight B. La Du,
State Engineer & Surveyor,
Albany, N. Y.

Dear Sir:

We have under consideration for immediate construction Hydrographic Works on Genesee River, on the Cohocton and on Keuka Lake Outlet, and would request that you furnish me with blank application for approval of detail plans and specifications as requested under the provisions of Chapter LXV of the Consolidated Laws, The Conservation Law.

Any information as to material which should be furnished, or any instructions to applicants which would facilitate the handling of these applications in your office would be appreciated.

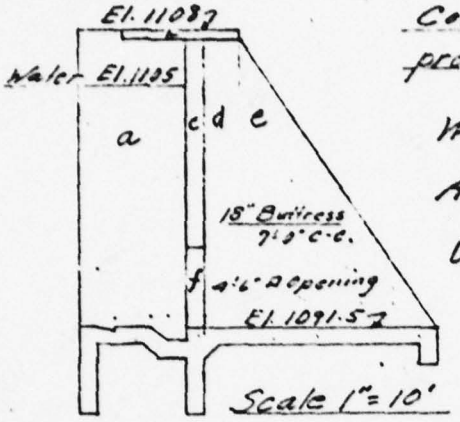
The early receipt of the application blanks would be greatly appreciated.

Yours very truly,

Robert O Hayt

ROH/H

Headworks for Wayne-Kauba Canal



Consider section at El. 1091.5. No adequate provision to cause concrete sill to act.

Water pressure $62.5 \times \frac{13.5^2}{2} \times 7 =$ 40000

Arm $= \frac{13.5}{3} = 4.5$

Uplift $\frac{2}{3} \times 13.5 \times 62.5 \times 1.5 \times 5 =$ 4200

Section	Volume	Cu. Ft.	Weight	Arm	Moment
a	$6 \times 16.5 \times 1.5$	148.5	21700	3.0	65100
b	$6.5 \times 0.5 \times 5.5$	17.9	2600	5.75	14900
c	$1.0 \times 16.0 \times 5.5$	88.0	12800	6.5	83200
d	$2.0 \times 16.5 \times 1.5$	49.5	7200	8.0	57600
e	$11.0 \times \frac{1}{2} \times 16.0 \times 1.5$	132.0	19100	12.67	242000
f	$-1.0 \times 4.5 \times 4.5$	- 20.2	-2900	6.5	- 18900
			60500		444000
Water Pressure		40000		4.5	180000
Uplift.			-4200	3.0	-12600
			56300		611400

Resultant $611400 \div 56300 = 10.86$ from upstream face

2.47' Inside middle third.

Coef. of Sliding $40000 \div 56300 = 0.71$

Pressure on gate and gate support $= 62.5 \times 11.25 \times 4'6" \times 5'6" = 17400$

Av. shear in concrete $= 17400 \div (54 \times 12 \times 2) = 13\frac{1}{2}$ Lbs

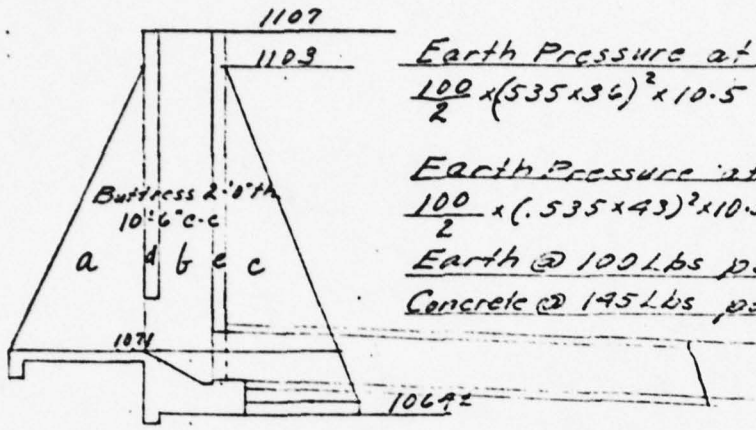
Curtain Wall M. $7 \times 62.5 \times 5.5^2 \times 1.2 = 15900$ In Lbs

As $= 0.25$, $d = 10"$ $p = \frac{25}{10 \times 12} = .0021$. $k = .219$ $j = .927$

$fs = 15900 \div 0.25 \times .927 \times 10 = 6900$

U.S.E. Inst. 3-2-25

Lamoka Power Corporation Development



Earth Pressure at 1071

$\frac{100}{2} \times (535 \times 36)^2 \times 10.5 = 189000$

Earth Pressure at 1064

$\frac{100}{2} \times (.535 \times 43)^2 \times 10.5 = 275000$

Earth @ 100 Lbs per cu. ft

Concrete @ 145 Lbs. per cu. ft.

Section at El. 1071

Section	Volume	Cu. Ft.	Weight	Arm	Moment
a	$15' \times \frac{1}{2} 32' \times 2'$	480	69600	26.5	1844000
b	$9' \times 36' \times 2'$	648	94000	17.0	1598000
c	$12.5 \times \frac{1}{2} 36' \times 2'$	450	65200	8.33	543000
d	$1.5' \times 30' \times 8.5$	382	55400	20.75	1150000
e	$1.5' \times 36' \times 8.5$	559	81000	13.25	1073000
			365200		6208000
Earth Pressure	189000			12.0	2205000
			365200		8413000

Position of Resultant $8416000 \div 365200 = 23.04$

$b = 36.5 \quad e = 23.04 - 18.25 = 4.79$

Toe P $365200 \div (2 \times 36.5) + 6 \times 365200 \times 4.79 \div (2 \times 36.5^2) = 8940$ Sq. Ft.

Curtain Wall

Earth Pressure at Top of Penstock $100 \times .535^2 \times 33' = 945$ Lbs. Sq. Ft.

$M = 945 \times 8.5^2 \times 1.5 \quad 102000$

$As = 3.56 - 1.68, \; d = 15" \; p = \frac{1.68}{12 \times 15} = .0094, \; k = .376 \; j = .875$

$fc = 204000 \div (0.376 \times 0.875 \times 12 \times 15^2) = 230$ OK. Shear is OK.

Short Curtain Wall

Pressure $= 34 \times 62.5 = 2130, \; R = 3 \times 2130 = 6390, \; M = 2130 \times 6^2 \times 1.5 = 115000$

$d = 12" \; a = 0.56$ (Assumed) $p = \frac{.56}{12 \times 12} = .0039 \; J = .904$

$fs = 115000 \div 0.904 \times 12 \times .56 =$

H.E.P. 3-3-37

Lamoka Power Corporation Development

Penstock Design

Maximum water surface 1105

Wooden penstock to El.	888	head 217'	
60" Steel 7/16"th to	El. 850	" 255'	
60" " 1/2"th to	El. 815	290'	
54" " 1/2"th to	El. 775	330'	
48" " 1/2"th to	El. 795	360'	

Tension in steel portion					
Pipe	Tension per in. width		Unit Stress (Gross Area)	Read Joint Eff. for 12000 in steel. Joint	
60"-7/16"m	0.434×255×30	= 3330	7620	6470	3/4" R.T.R.L.
60" 1/2" m	0.434×290×30	3780	7560	6370	3/4" R T R L
54" 1/2" m	0.434×330×27	3770	7740	6570	do
48" 1/2" m	0.434×360×29	3750	7500	6370	do

Data on wood stave pipe to be furnished later.

H6.B

Lamoka Power Corporation Development.

Face wall of Buttress

Height 16'-6" span 13'-0" (Figure as simple beam)

Pressure per sq. ft. = $16.5 \times 0.535^2 \times 100 = 475^{\#}$ Sq. Ft.

$M = 475 \times 13^2 \times 1.5 = 121000$ In Lbs.

$a = 0.50^{\square}$ $d = 21"$ $p = 0.50 \div 12 \times 21 = .002$ $k = 0.217$ $j = 0.928$

$fs = 121000 \div 0.928 \times 21 \times 0.50 = 12400^{\#}$ Sq. In.

Vertical beam at valve opening

Pressure = $14.5 \times 0.535^2 \times 100 = 415$ Lbs Sq. Ft.

Pressure per lin. ft. = $415 \times 18 \div 2 = 3730$

$M = 3730 \times 7.5^2 \times 1.5 = 114000$ In Lbs.

$a = 0.50$, $p = 0.50 \div 12 \times 27 = .0016$, $j = .936$

$fs = 114000 \div 0.936 \times 0.50 \times 27 = 9000^{\#}$ Sq. In.

Side wall between buttresses

Pressure $11' \times 535^2 \times 100 = 315$ Lbs Sq. Ft.

Span = 15'-0" $M = 315 \times 15^2 \times 12 = 95000$

$a = 0.5$ $p = 0.5 \div 12 \times 11 = .0038$ $j = .905$

$fs = 95000 \div 0.905 \times 11 \times 0.5 = 19000$

Lamoka Power Corporation Development

Buttress Walls for Penstock Headworks

Earth pressure at bottom of wall

$19' \times .535 \times 2.00 = 545$ Lbs Sq. Ft. $M = 545 \times 15^2 \times 1.5 = 184000$

Figure span to far wall $M = 545 \times 18^2 \times 1.5 = 264000$

$d = 21"$ $a = 1.00 \times 2/3$ 0.67 $p = 0.67 \div 12 \times 21 = .0027$

$k = 0.244$ $j = 0.918$ $f_s = 184000 \div 0.918 \times 21 \times 067 = 14300$

264000 do $= 20400$

Gates for Penstock.

$h = 36'$ on lowest intermediate U, Us 19" c-c.

load per lin. ft. $= 62.5 \times 36 \times 1.17 = 2640$ Lbs per lin. ft.

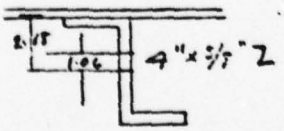
span $= 5'-7"$ $M = 2640 \times 5.67^2 \times 1.5 = 127000$ In. Lbs.

14" × ¾" Pl. A = 5.25

$\frac{5.25 \times 2.18}{5.25 + 2.12} = 1.55$

$I = 4.6 + 2.12 \times 1.55^2 + 5.25 \times 0.63^2 = 11.8$

Sec Mod $= 11.8 \div 3.55$ 3.32 $f_s = 127000 \div 3.32 = 38300$



$\frac{5.25 \times 2.18}{5.25 + 5.55} = 1.06$

$I = 12.1 + 5.55 \times 1.06^2 + 5.25 \times 1.12^2 = 24.9$

Sec. Mod. $= 24.9 \div 3.06 = 8.15$ $f_s = 127000 \div 8.15 = 15600$

11 a m

LAMOKA POWER CORPORATION

CORNING, N. Y.

March 11, 1925.

Roy G. Finch, State Engineer.
Albany, N. Y.

Dear Sir:-

Acknowledgment is made herewith of your letter of March 7th, 1925, approving drawings in connection with Dam 377, Chemung, Bradford, submitted by our engineer, Mr. Robert O. Hayt, of Corning, N. Y.

It is noted what you state as to temporary bridge shown on drawing No. 3, and would state that we are informed that this plan has been submitted the Highway Commission for approval.

It is further noted what you state as to drawings Nos. 12-13-14 and 15, and would state that on receipt of manufacturers' plans they will be submitted your office for approval prior to construction.

It is desired to start the work as soon as possible, and immediately definite arrangements have been consummated for the construction your office will be notified.

Thanking you for the courtesies extended our engineer, Mr. Hayt, we are

Yours very truly,

LAMOKA POWER CORPORATION,

By George F. Stevens
Secretary,

Copy to Mr. Robert O. Hayt,
Corning, N. Y.

GFS/W.

MEMORANDUM FOR MR. A. R. McKIM, INSPECTOR OF DOCKS AND DAMS.

I have examined the plans prepared by Robert O. Hayt, Consulting Engineer for the Wayne Keuka Development of the Lamoka Power Corporation. These plans as originally drawn had several features of construction which did not meet with my approval. In all such cases the plans have been changed by Mr. Hayt. As these changes have been explained to you verbally, I see no need to give a detailed account of them here.

The plans in their present condition are ready for approval except in the following respects:

Sheet No. 3 shows a temporary bridge to be used where roads cross the canal. I have made no examination of this feature as I understand that this will come under the jurisdiction of the Highway Commission.

Sheet No. 12 shows a profile of the penstock. This penstock is to be partly of wood stave pipe and partly of steel pipe. There are no details as to the construction of the wood stave pipe and only metal thickness for the steel pipe. Mr. Hayt understands that it will be necessary to submit these details for approval as soon as he is certain as to what they will be.

Sheets 13, 14 and 15 are merely outline sketches of the power house. These are not ready for approval. Details of this power house are to be submitted later.

Assistant Engineer.

H. E. Brainard

March 6, 1925.

Albany, N. Y.
March 9, 1926.

State Engineer & Surveyor
Albany, N. Y.

Dear Sir —

Refering to your letter of March 7, 1925 approving drawings Lamoka Power Corporation dam 377, Chemung, Bradford we wish to submit the following for your approval.

Original Drawing No.	Substituted Drawing No.	Changes.
File No. 591	File No. 591-2	Power house moved across road and into lake. 75.95 feet from former point.
File No. 581	File No. 581-2	Sluice gate openings instead of flat openings. Also buttress left out as structure is moved onto solid ground instead of fill
File No. 587	File No. 587-2.	Power house moved across road and into lake. 75.95 feet from former point.
File No. 592	Notation of change in location of power house and lead marks made on drawing.	

Robert O Haight

Journal Building, Plaza,
P. O. Box 524.

Dam No. 377, Chemung, Bradford.

March 11, 1926.

The Lamoka Power Corporation,
Corning, N. Y.

Gentlemen:

This department acknowledges the receipt from your engineer of a letter dated March 9, 1926, and the following tracings for dam No. 377, Chemung Watershed, at Bradford:

Drawing No. 1, File No. 592, has changed the controlling works, as shown on drawing No. 8 and labeled "Headworks", to just above the Bath-Penn Yan highway and the power house moved 75.95 feet across the road and into the lake.

Drawing No. 7, File No. 587-2 is to be substituted for drawing No. 7, File No. 587. The only change is that the power house is moved across the road.

Drawing No. 8, File No. 581-2, is substituted for drawing No. 8, File No. 581. The only changes are that the headworkson the former drawing has 6 gate openings instead of 4 as shown on the latter drawing and one of the two double buttresses on each side of the gates is omitted.

Drawing No. 12, File No. 591-2, is substituted for drawing No. 12, File No. 591. The only change is that the power house on the former drawing is moved across the road.

The above changes meet the approval of this department if the headworks are built on solid ground and the excavations made in the bed be refilled with compacted concrete. This approval is supplementary to and forms a part of our letter of approval of March 7, 1925.

The Lamoko Power Corp. #2 3/11/26.

We have stamped the substituted drawings No. 7, 8 and 12 with the approval of this department and have also redated drawing No. 1.

The above tracings are at this office and will be forwarded if you so desire.

Please acknowledge the receipt of this letter.

Very truly yours,

Roy G. Finch,
State Engineer

By
Deputy State Engineer.

Copy to-

Robert O. Hart,
Corning, N. Y.

Division Engineer Summers.

ARMcK/F.

LAMOKA POWER CORPORATION

CORNING, N. Y.

March 15, 1936.

377 che

Mr. Roy G. Finch,

State Engineer and Surveyor,

Albany, N. Y.

Dear Sir:-

Your letter of March 11, 1936, approving certain changes in plans of the Lamoka Power Corporation, of Corning, New York, approved by your office March 7, 1935, your file "Dam No. 377, Chemung, Bradford" is acknowledged herewith.

The Engineer of the Lamoka Power Corporation, Mr. Robert O. Hayt, will advise as to the disposition to be made of the tracings.

Thanking you for your prompt consideration in the matter, also for the courtesies extended, we are

Yours very truly,

LAMOKA POWER CORPORATION,

By Geo. F. Graves
Secretary.

J. S. SUMMERS, Division Engineer

STATE OF NEW YORK

S/L DEPARTMENT OF STATE ENGINEER AND SURVEYOR

WESTERN DIVISION

BARGE CANAL TERMINAL BLDG.

SUBJECT: Dam No. 377, Chemung, ROCHESTER Aug. 27, 1926.
Bradford.
Inspection.

Hon. Roy G. Finch,
State Engineer,
Albany, N. Y.

Dear Sir:-

Pursuant to your request of August 11th, I made an examination of Bradford Roller Mill dam, at Bradford, Steuben Co., N. Y., on August 26th.

This dam is built in two sections, viz., a concrete section some 25-feet in length, which is in very good condition, but a timber section some 18-feet in length is in the last stages of decay.

There was very little water impounded above the dam and from the amount of water leaking through the timber section it would appear impossible to impound any considerable quantity of water except in case of greatly increased creek flow in times of wet weather.

The mill was closed and a notice on the door read that grinding was done only on Wednesdays and Saturdays.

Inquiry locally brought the information that this mill had been sold and was now owned by the Lamoka Power Corporation, which planned to reconstruct this dam in connection with their general power development project in this territory.

Upon returning to this office I find that plans for the construction of a dam at this location have been approved under date of March 7, 1925. A topographic map accompanying this approval indicated a dam at Bradford, maked "First stage temporary" and designated "No. 377 Chemung Watershed." A detailed location is given on sheet #17 of approved plans.

My first thought upon inspecting the dam was to recommend the reconstruction of the timber section immediately if the dam were continued in use. In the light of the existing approval it appears that such reconstruction is contemplated and it is only a question of how soon such reconstruction is started. I was unable to find any one locally who could give me definite information on this point.

Very truly yours,
J.S.Summers J. S. Summers Div. Engineer.

Journal Building, Plans,
P.O.Drawer 629.

Dam 377, Chemung
Bradford

August 30, 1926.

Lamoka Power Corporation,
Corning, N. Y.

Gentlemen:

Permission was granted on May 7, 1925, to November 1, 1926, for the reconstruction of a dam on Mud creek at Bradford. Has any work been done on this reconstruction and, if not, is the work to be undertaken this season?

Very truly yours,

Roy C. Finch,
State Engineer

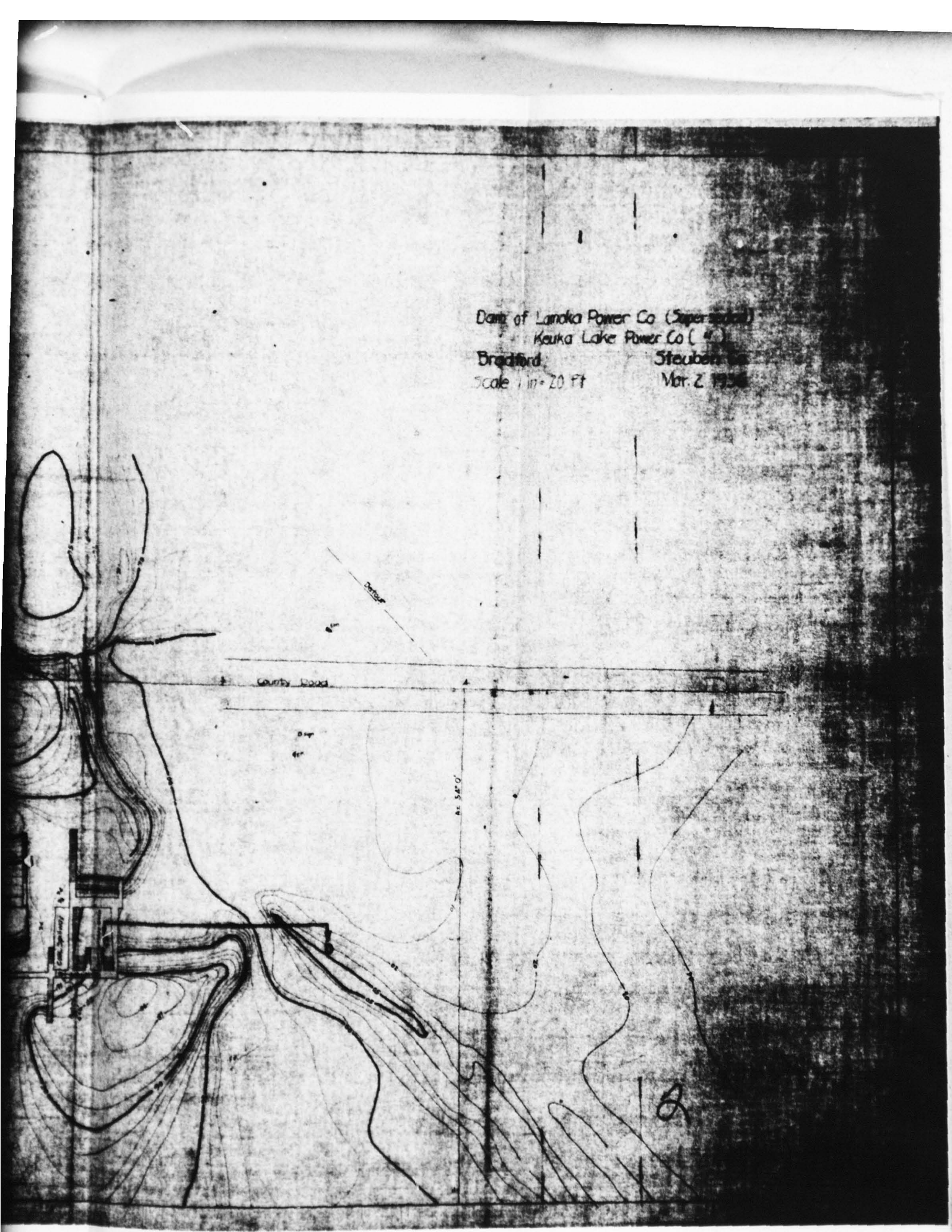
By
Assistant Deputy.

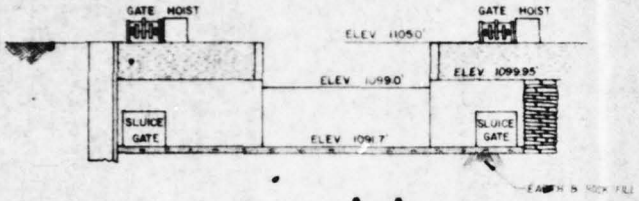
AMcK/F.

APPENDIX E

CONSTRUCTION DRAWINGS

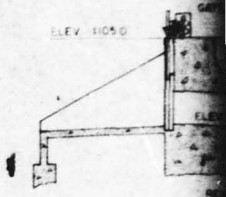

READING
STARKEY
RANGE
Earth Fill
Earth Fill
House
Car

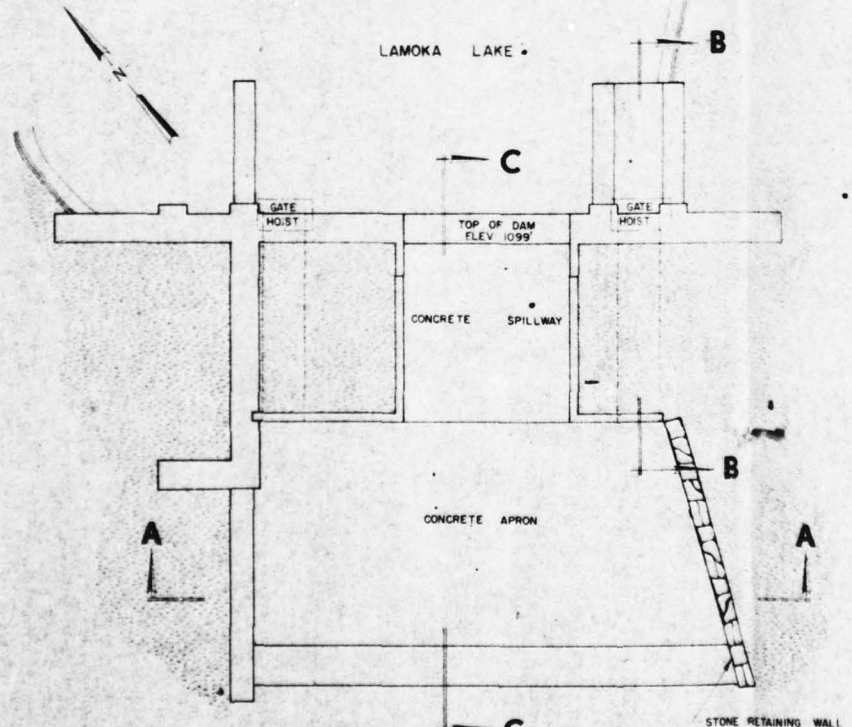

Dam of Lanoka Power Co (Superseded)
Keuka Lake Power Co (")
Bradford
Steuben Co
Scale 1 in = 20 Ft
Mar. 2 1926
County Road
N 54° 0'
18



SECTION **A-A**

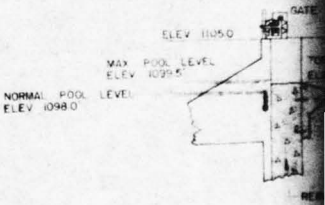
ELEVATION OF DAM LOOKING UPSTREAM





PLAN VIEW

OF BRADFORD DAM



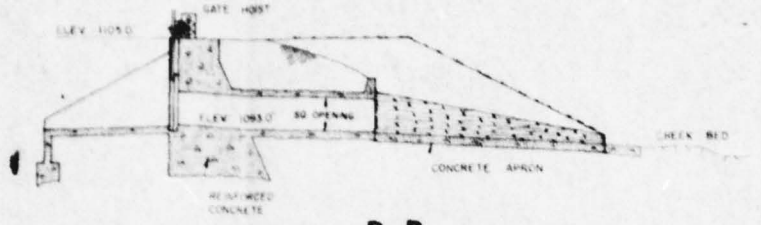
THIS DRAWING IS PART OF
FOR LICENSE MADE BY
THIS 16TH DAY OF MAY

NEW YORK STATE ELECTRIC

BY _____

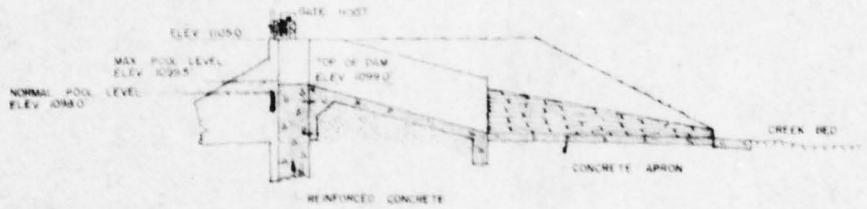
TITLE SENIOR VICE

1



SECTION **B-B**

SECTION OF SLUICE GATE & APRON



SECTION **C-C**

SECTION OF SPILLWAY

THIS DRAWING IS PART OF THE APPLICATION FOR LICENSE MADE BY THE UNDERSIGNED THIS 16TH DAY OF MAY 1978

NEW YORK STATE ELECTRIC & GAS CORPORATION

BY _____

TITLE SENIOR VICE PRESIDENT

NEW YORK STATE ELECTRIC & GAS CORPORATION
ITHACA, N.Y.

KEUKA HYDRO PROJECT DEVELOPMENT
KEUKA, N.Y.

EXHIBIT L SHEET 2 OF 6

"PLAN & SECTIONS OF BRADFORD DAM"

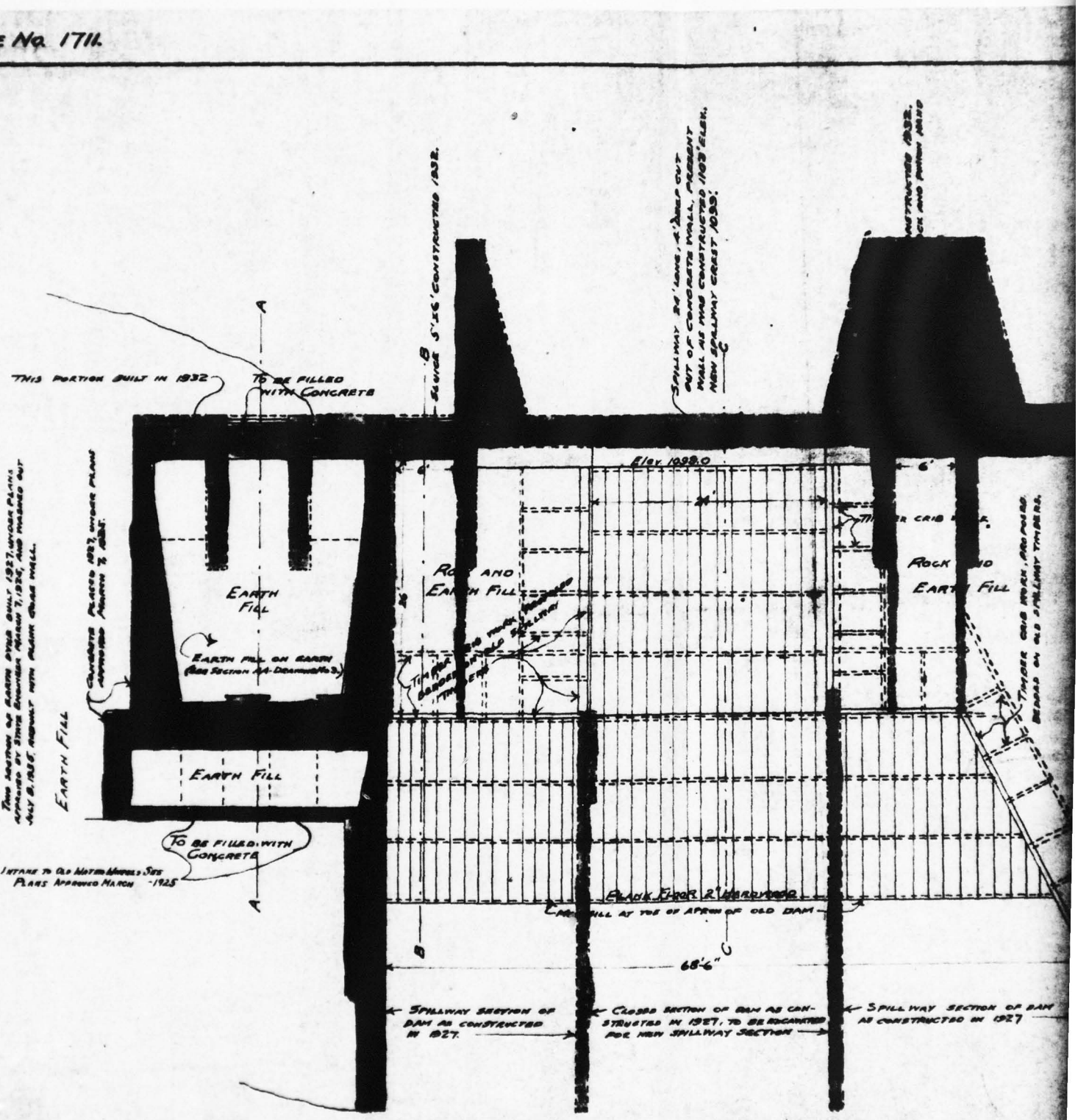
SCALE: 1"=8'-0"

8 0 8 16 24 32 40

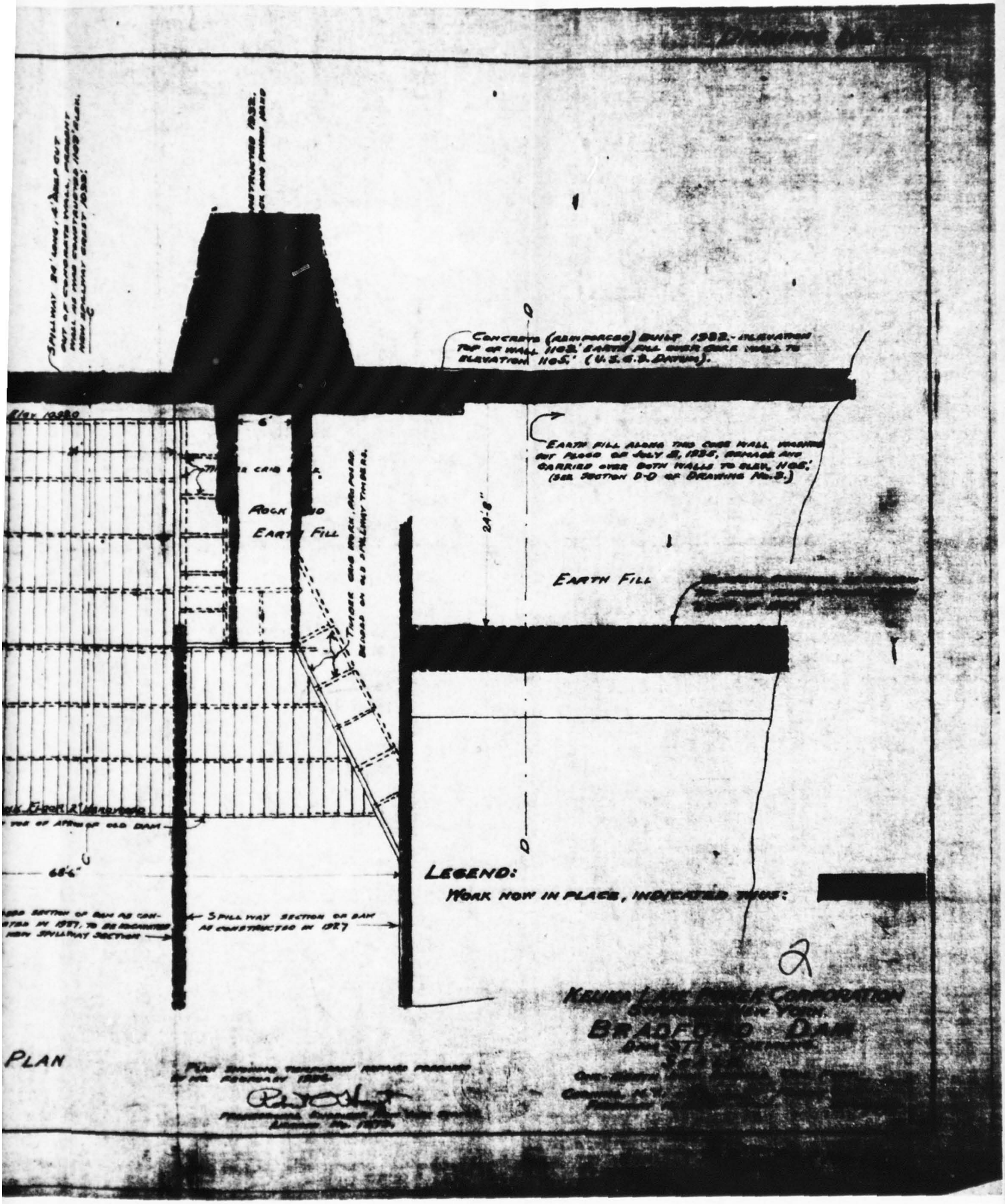
NYSE&G NO. D-7223

9

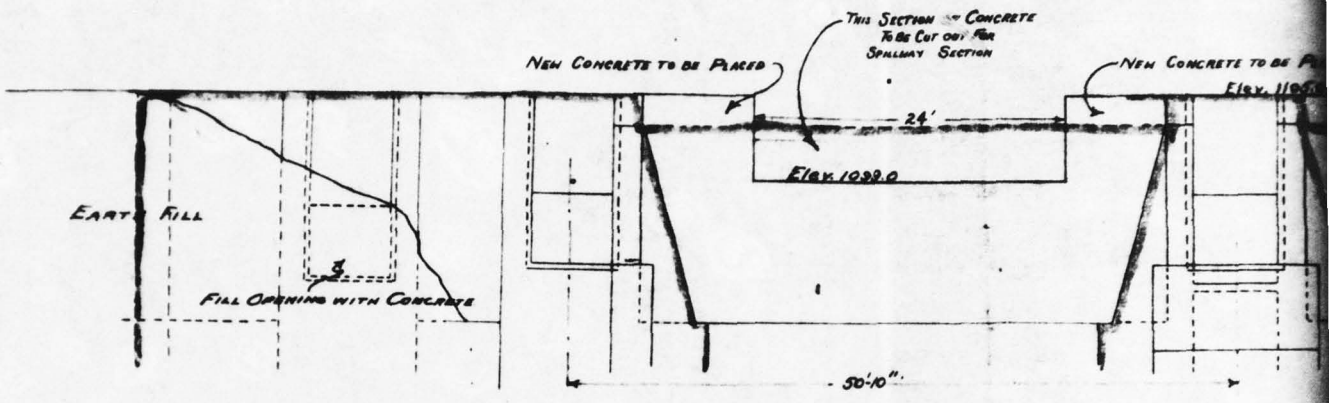
FILE No. 1711.



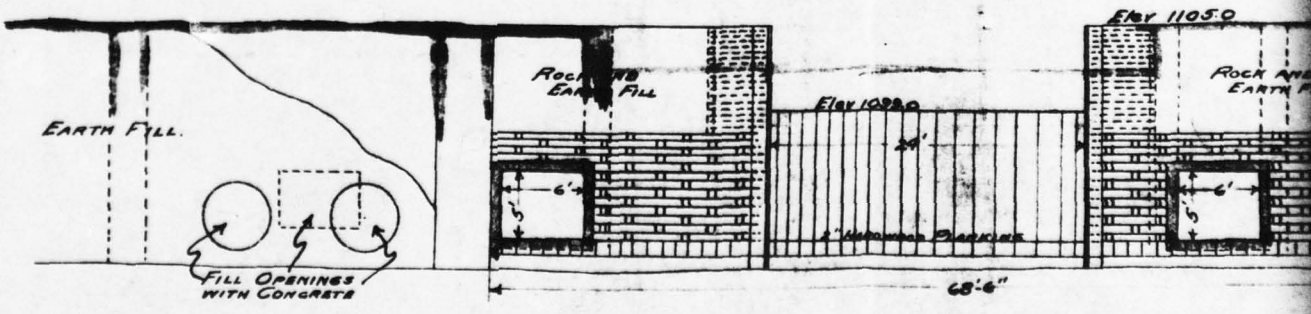
PLAN


CONCRETE (REINFORCED) BUILT 1932.- ELEVATION TOP OF WALL 1102.' EARTH FILL OVER CURB WALLS TO ELEVATION 1105.' (U.S.C.&G.S. DATUM).
EARTH FILL ALONG THIS CURB WALL WASHED OUT FLOOD OF JULY 8, 1935, DAMAGE AND CARRIED OVER BOTH WALLS TO ELEV. 1105.' (SEE SECTION D-D OF DRAWING No. 3.)
EARTH FILL
ROCK AND EARTH FILL
THESE CRIB WORK FOUNDATIONS RESTED ON OLD SPILLWAY TIMBERS.
24'-8"
68'-6"
LEGEND:
WORK NOW IN PLACE, INDICATED THUS:
SPILL WAY SECTION OF DAM AS CONSTRUCTED IN 1927
PLAN

FILE No. 1712.

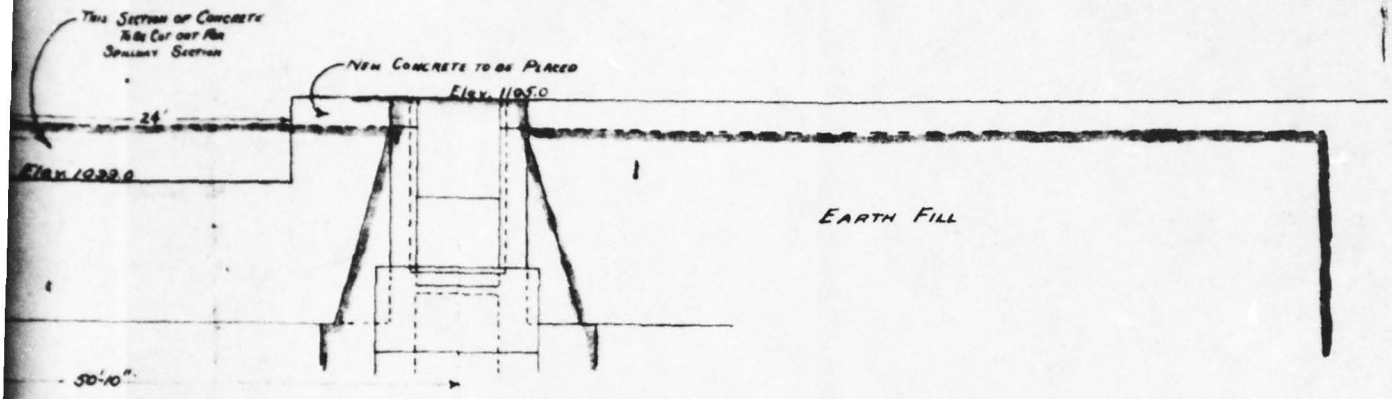


ELEVATION LOOKING DOWN-STREAM



ELEVATION LOOKING UP-STREAM

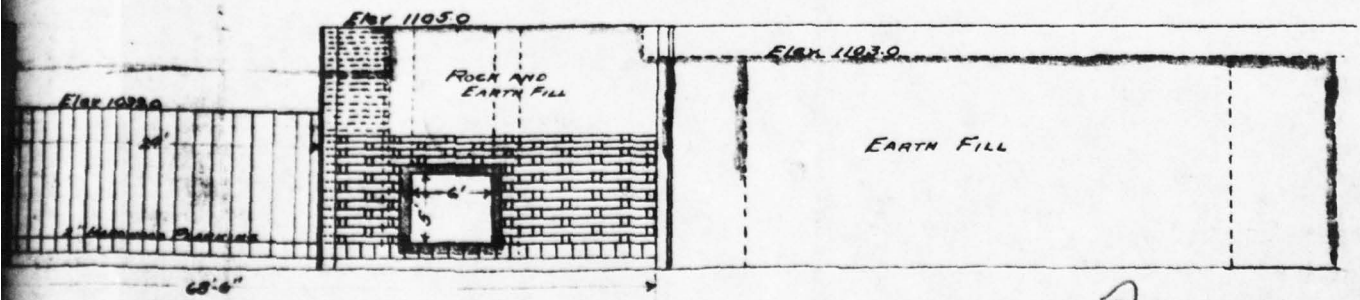
DRAWING No. 2.



ATION LOOKING DOWN-STREAM

LEGEND:

WORK NOW IN PLACE, INDICATED THUS:



EVATION LOOKING UP-STREAM

2

KEUKA LAKE POWER CORPORATION
SYRACUSE, NEW YORK.

BRADFORD DAM

DAM 377 – CHEMUNG.

SCALE

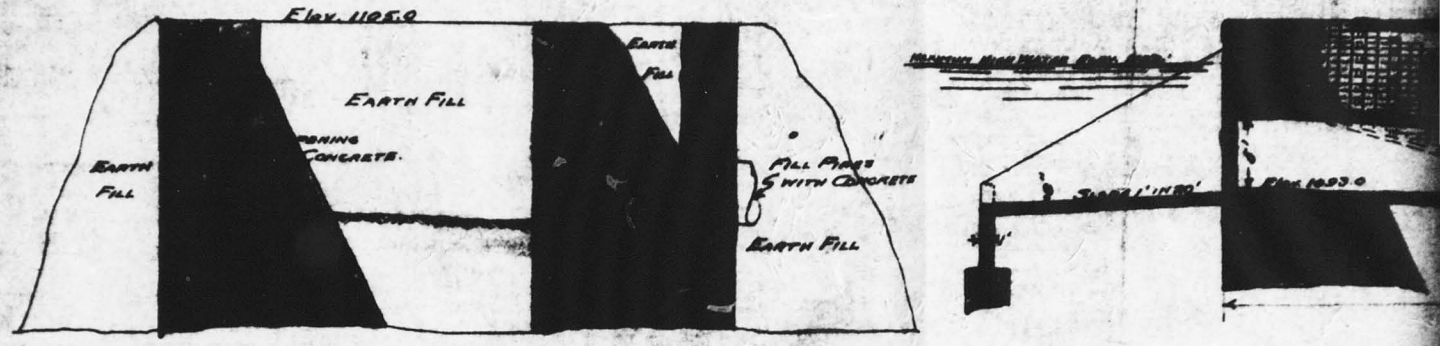
ONE-EIGHTH INCH EQUALS ONE FOOT.

CORNING, N.Y.
FEBRUARY 11, 1936.

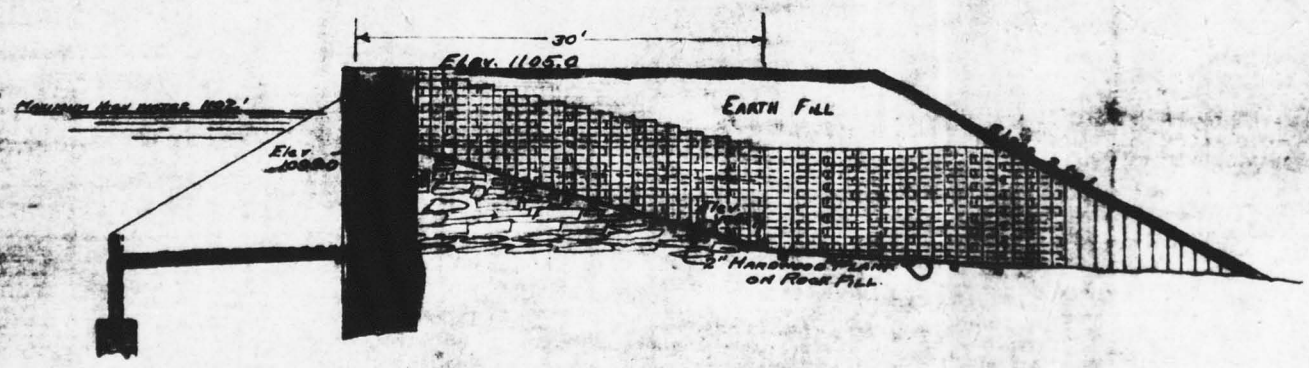
ROBERT O. HATT.
ENGINEER.

FILE No. 1912

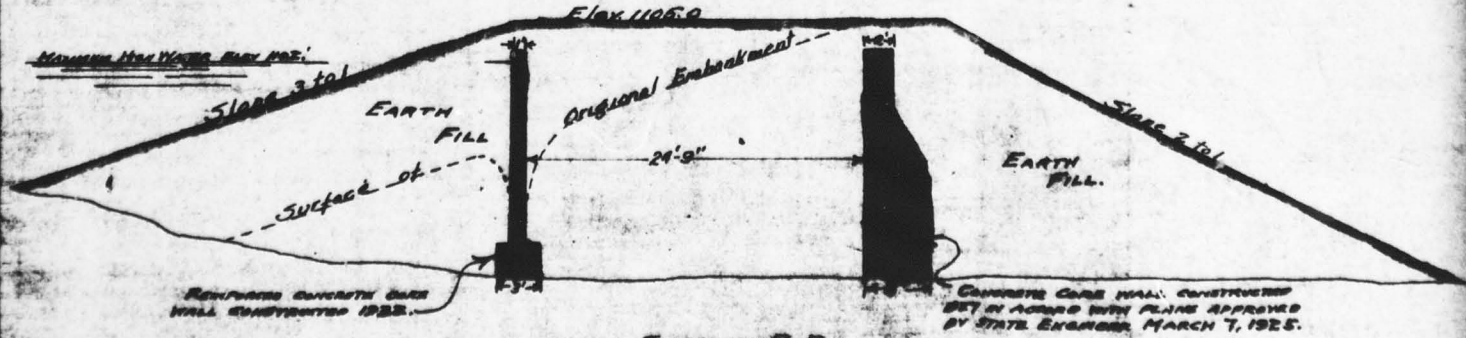
No. 1715



SECTION A-A

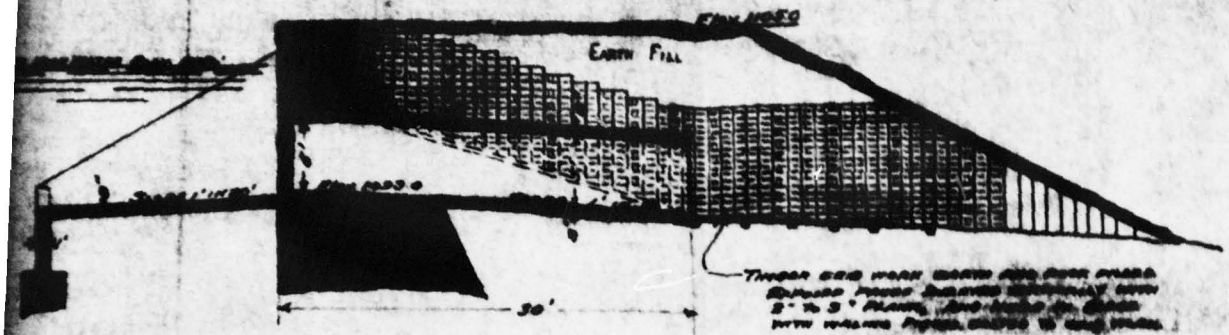


SECTION C-C



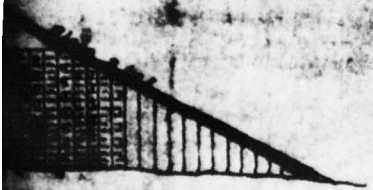
SECTION D-D

Drawing No. 2

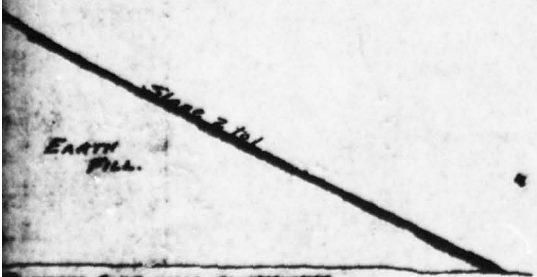


SECTION B-B

NOTE:
TIMBERS IN CRIB WORK ALL SIDES, TIMBERS FROM OLD MILL, AND TIMBER NOT USED TO BE USED, ALL THOROUGHLY SCRUBED AND DRIFT BOLTED IN PLACE, AND TO TIMBERS OF OLD DAM.
ALL EXPOSED FACES OF CRIB WORK TO BE DRESSED WITH 2" AND 3" PLANK SECURELY NAILED TO CRIB TIMBERS WITH 40 AND 60 d. NAILS, AND HELD IN PLACE BY WALING PIECES (THICKNESS) 2" THICK. WALING PIECES TO BE BOLTED TO CRIB TIMBERS WITH 4/8 INCH BOLTS 12" AND 16" LONG.



LEGEND:
WORK NOW IN PLACE, INDICATED THUS: [redacted]



CRIB WALL CONSTRUCTION
IN ACCORD WITH PLANS APPROVED
STATE ENGINEER, MARCH 7, 1925.

2

KEUKA LAKE POWER CORPORATION
SYRACUSE, NEW YORK.

BRADFORD DAM

DAM 377 - CHEMUNG.

SCALE
ONE-EIGHTH INCH EQUALS ONE FOOT.

CORNING, N.Y.
FEBRUARY 11, 1926.

ROBERT O. HAYT
ENGINEER

FILE, No. 1712.

APPENDIX F

VISUAL CHECK LIST

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME DAM Bradford Dam COUNTY Steuben STATE New York ID# 674

TYPE OF DAM Concrete Gravity/Retaining wall & Earthfill HAZARD CATEGORY Low

DATE(s) INSPECTION August 30, 1978 WEATHER partly cloudy TEMPERATURE 80°

POOL ELEVATION AT TIME OF INSPECTION 1098.6 M.S.L. TAILWATER AT TIME OF INSPECTION 1091± M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - LRK
Richard Ondreyko - Owner's Personnel
James T. Hockensmith - LRK

R. Jeffrey Kimball RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	No deviations noted	
RIPRAP FAILURES	No rip rap	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junction with concrete section appeared to be OK with exception of seepage.	
ANY NOTICEABLE SEEPAGE	Seepage at toe of earth section at junction of right embankment with concrete section.	
STAFF GAGE AND RECORDER	Staff gage on concrete section.	
DRAINS	None	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not through concrete section	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Junction with earth sections appeared to be OK - seepage noted in earth section right side.	
DRAINS	None	
WATER PASSAGES	2 tunnels either side of section - good condition.	
FOUNDATION	Partly on natural rock and partly on rock fill (Left abutment). Apron is undermined. Water is laying below and condition unknown.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	No major cracks noted.	
STRUCTURAL CRACKING	None	
VERTICAL AND HORIZONTAL ALIGNMENT	No deviations noted	
MONOLITH JOINTS	None	
CONSTRUCTION JOINTS	No openings noted at any joints	
STAFF GAGE OF RECORDER:	On upstream face	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Two sluice tunnels.	
INTAKE STRUCTURE	Sluice gates on front of concrete dam with electric hoists	
OUTLET STRUCTURE	Discharges to concrete apron - needs repairs	
OUTLET CHANNEL	Mud Creek - under highway bridge - No constructions.	
EMERGENCY GATE	None - sluice gates only	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Broad crested weir at entrance in good condition	
APPROACH CHANNEL	None	
DISCHARGE CHANNEL	Sloping concrete channel formed by concrete retaining walls discharges to concrete apron in need of repair	
BRIDGE AND PIERS	Highway bridge just downstream - deck above top of dam	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Begins with concrete apron which has several large holes and water flowing under apron and under right wing wall. Mud Creek downstream is vegetated natural stream bed	
SLOPES	Relatively gentle in flood plain	
APPROXIMATE NO. OF HOMES AND POPULATION	1 structure 4000' downstream. 9 miles downstream town of Savona - several thousand	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Steeply sloping hillsides above lakes	
SEDIMENTATION	None noted	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	Staff gage on dam	

APPENDIX G

ENGINEERING DATA CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Bradford

ID# 674

ITEM	REMARKS
AS-BUILT DRAWINGS	Not available
REGIONAL VICINITY MAP	Quad Sheet Only
CONSTRUCTION HISTORY	None available - construction in 1950 after failure
TYPICAL SECTIONS OF DAM	From 1978 licensing drawings
OUTLETS - PLAN	1978 drawings
- DETAILS	1978 drawings
- CONSTRAINTS	None
- DISCHANCE RATINGS	None
RAINFALL/RESERVOIR RECORDS	None

ITEM	REMARKS
DESIGN REPORTS	None
GEOLOGY REPORTS	None
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Not known

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None reported since 1950
HIGH POOL RECORDS	Apparently Agnes 1972 - no records
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	1936 and 1950 failures of wooden structures at same site some correspondence avaialable
MAINTENANCE OPERATION RECORDS	No formal records - Annual inspection reports made

REMARKS

SPILLWAY PLAN	1978 Drawings
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	No details on hoists

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 44.8 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1099 - 60,000 acre-feet

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1105 - 74,999 acre-feet

ELEVATION MAXIMUM DESIGN POOL: Not known

ELEVATION TOP DAM: 1105

CREST:

a. Elevation 1099
b. Type Broad crested weir - concrete
c. Width 4'
d. Length 23' weir length - spillway width
e. Location Spillover center of dam - concrete section
f. Number and Type of Gates none

OUTLET WORKS:

a. Type 2-5'x5' sluice tunnels
b. Location either side of concrete section
c. Entrance inverts 1093
d. Exit inverts 1093±
e. Emergency draindown facilities none

HYDROMETEOROLOGICAL GAGES:

a. Type none
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE not known